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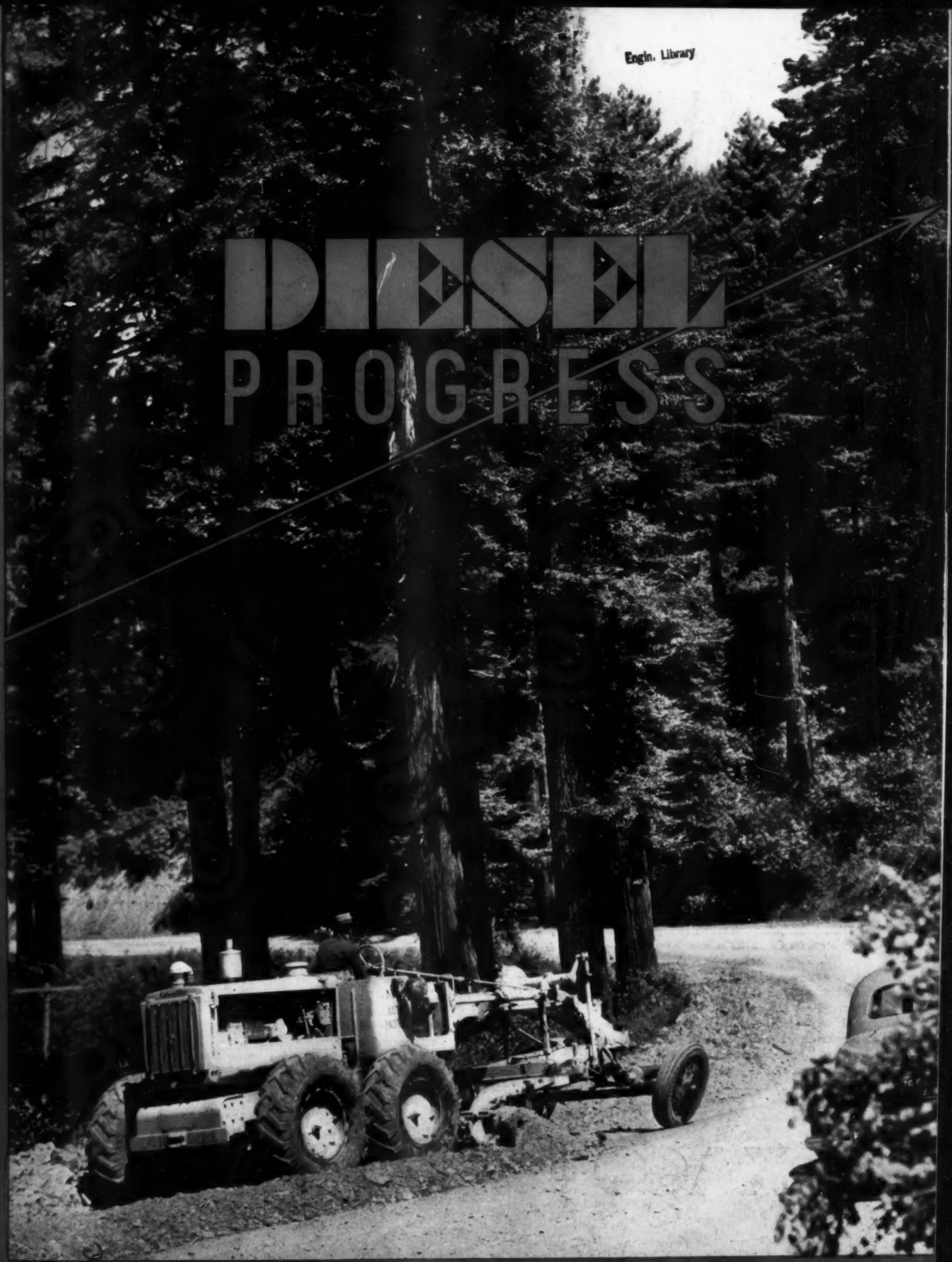
DIESEL PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR



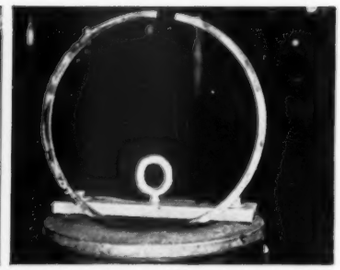
OCTOBER, 1939 CIRCULATION OF THIS ISSUE—IN EXCESS OF 14,000 COPIES 25c

EVIDENCE THAT DIESELS KEEP CLEAN

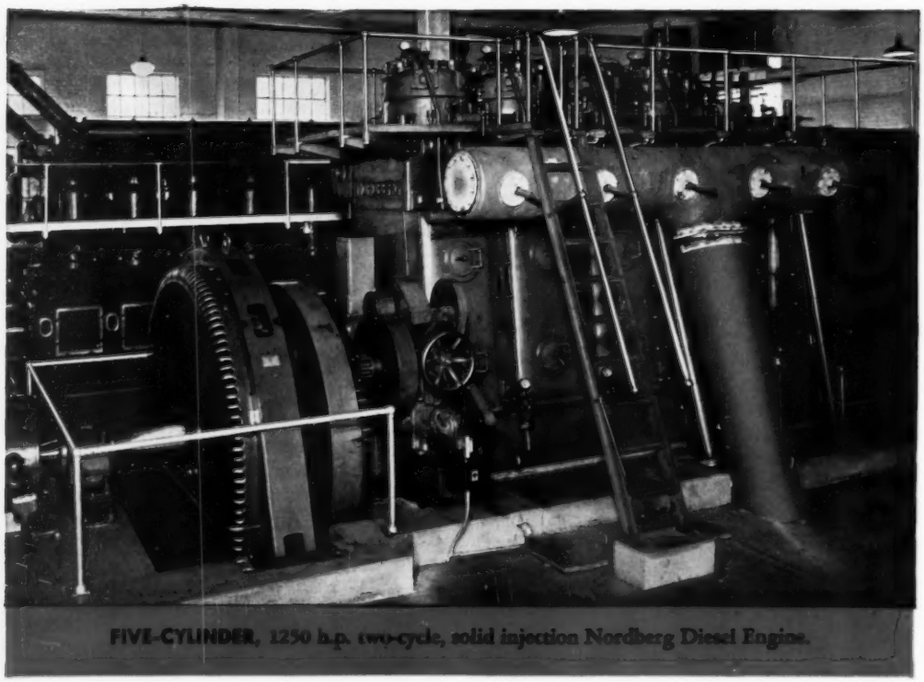
THE WATCH ENGINEER and his helper pulling piston No. 5.

CHIEF ENGINEER and the watch engineer find each ring free in its groove, as expected.

THE WATCH ENGINEER "miking" the upper compression ring for wear. (P.S. He found none.)



CLOSE-UP, showing first compression ring removed. Note clean ring groove.



FIVE-CYLINDER, 1250 h.p. two-cycle, solid injection Nordberg Diesel Engine.

INSPECTING a cross-head and guide. Entire inside of engine's crankcase is clean, free from sooty deposits.

LOOKING THROUGH cylinder No. 5. All ports clean. Cylinder wall mirror-like.

THESE PICTURES were taken in a power plant at Tarboro, N. C., at the regular annual inspection period. *They have not been retouched.* Neither were any parts wiped off. The photos show everything exactly as it appeared when No. 5 piston was pulled for inspection.

Note the free rings, the mirror-like surfaces, the freedom from sludgy deposits. These are direct results of lubricating with Texaco Algol or Ursa Oils.

You, too, can keep your Diesels clean . . . and efficient . . . by using Texaco Algol or Ursa Oils.

More stationary Diesel horse-power in the U. S. is lubricated with Texaco than with any other brand.

Experienced Lubrication Engineers, trained in the selection and application of Texaco Diesel Lubricants, will be glad to demonstrate that savings can be made with Texaco Perfected Lubrication.

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DIESEL PROGRESS and DIESEL AVIATION

REX W. WADMAN
Editor and Publisher

FRONT COVER ILLUSTRATION: Diesel engines maintain efficiently thousands of miles of secondary roads as typified by this Caterpillar Diesel grader spreading subgrade, shaping shoulders, etc., on Route 101, six miles south of Orick, California.

TABLE OF CONTENTS ILLUSTRATION: The 108 foot auxiliary ketch *Athene*, owned by Frank Borzage of Los Angeles, powered with a six cylinder, 165 hp. Gray Marine Diesel with a 3:1 reduction gear; speed, eight knots.

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HEYWORTH CAMPBELL
Art Director

PAUL. H. WILKINSON
Aviation Editor

CCA

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HUTCHINSON, MINNESOTA

By W. R. STROHMEIER*

CONSTRUCTED during 1936 and put into operation on November 27 of the same year, the original installation of engine and generator units in the Hutchinson municipal electric plant consisted of three 625 hp. McIntosh & Seymour 5-cylinder, 17½" x 25", 4-cycle Diesel engines directly connected to three Allis-Chalmers 538 kva., 80 P.F., 60-cycle generators. (See the March, 1938, issue of DIESEL PROGRESS.)

Originally the plant had been designed for three 450 hp. units but, because of the contemplated service to a rural load of considerable size and the fact that the local load was found to be growing at a rapid rate, the 625 hp. units were decided upon.

The proposed REA project materialized rapidly and, with the local use growing beyond all expectations, it was apparent late in 1937, with the new plant in operation less than one year, that within the coming year additional power would be required if a reasonable margin of safety of installed power over actual load was to be held. This the Commission desired to maintain.

Accordingly, Mr. Leon A. Winter of the Buell & Winter Engineering Company, the consulting engineer for the original construction, was instructed to prepare plans and specifications for Unit No. 4, and at that time it was decided to install as large a unit as was practicable for the available space, but still keep the unit in the slow speed range.

Bids were received on May 6, 1938, and as the bid from the Nordberg Manufacturing Company was the most satisfactory, a contract was entered into immediately for the furnishing and installation of a Nordberg type TS176, 1,500 hp., 2-cycle, 6-cylinder, 17" x 25", 257 rpm., trunk piston engine direct-connected to a 1,250 kva. .80 P.F. Allis-Chalmers alternator.

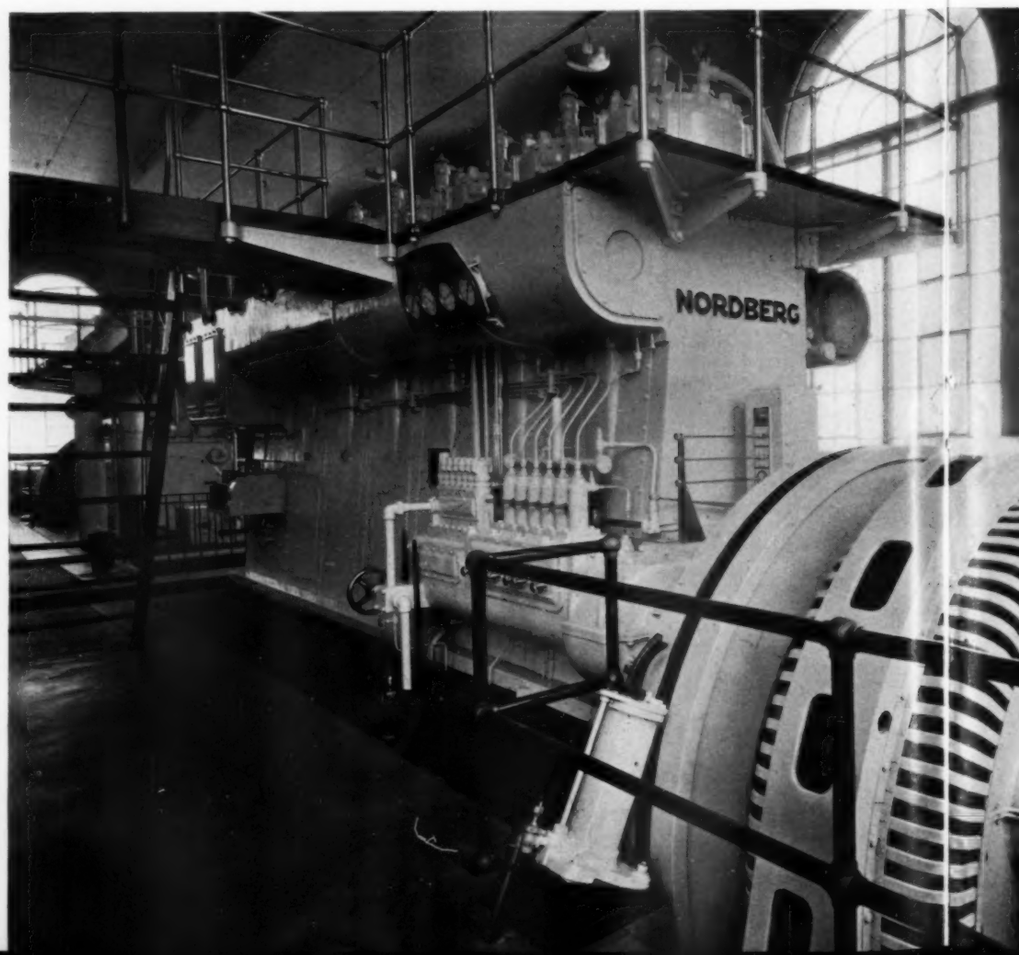
The contract covered a complete installation, which included foundations, all accessories, necessary switchboard changes and additions, painting, etc., to the end that all work for the complete job was embraced in the single contract. Construction of the engine was begun at once and, on October 23, the unit was placed in service. During the construction period, all three of the smaller units were required daily during the peak load period and, during the holiday season of 1938, a peak load of 1,380 kw. was carried.

Prior to rough construction work, dust tight partitions were erected in both the engine room and basement, so that practically all dust and dirt would be excluded from the operating portion of the plant. This work was started early in August, the engine completed and tested at the factory a month later and, as noted above, installation in the plant and preliminary adjustments, etc., making the unit available for regular operation, were completed by late October.

Accessories furnished with the engine include an Allis-Chalmers Type SSN pumping unit of 400 gpm. capacity at 70′ head for circulation of the jacket water through a Schutte & Koerting size 6.12X heat exchanger. The oil cooler is also Schutte & Koerting, size 7.12X, with a Viking Model ZQ auxiliary oil pump for circulation of the lubricating oil to bearings and the oil cooled pistons during starting and shutting down of the unit. The duplex lubricating oil filter is Nordberg. The fuel oil filter, also of the duplex type, is of Nugent manufacture, and the fuel oil is metered through a Pittsburgh Equitable meter of the positive displacement type, insuring accuracy in the fuel oil consumption readings. As with the McIntosh & Seymour engines, the Nordberg unit is equipped with a Woodward governor and Bosch injection system.

The intake and exhaust lines are 18 in. diameter, and the exhaust line from engine to muffler is insulated with 1½ in. Johns-Manville 85 per cent magnesia. The muffler was made by Nordberg and, because of the location of the plant building adjacent to a residential section, a muffler of ample size, approximately 42 in. in diameter by 26 ft. long, was used. The air filter is an American Air Filter Company's Type 9-OC-H.

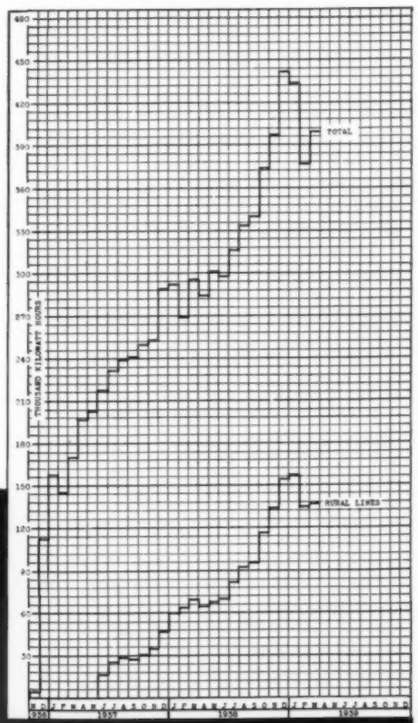
Generator view of the new 1,500 hp. Nordberg Diesel engine installed in the Municipal Light Plant at Hutchinson, Minnesota, with one of the five-cylinder, 625 hp., McIntosh & Seymour Diesels in the background.



*Superintendent, Municipal Electric Plant, Hutchinson, Minnesota.

Cylinder and scavenging pump lubrication is by means of a bank of 2 Manzel force feed lubricators, having a total of 25 feeds. To avoid the slight fumes due to the usual style of breathers on the crankcase, these were all closed off with the exception of No. 1 and No. 6 cylinders. The breather at No. 6 cylinder was partially closed, leaving an opening only large enough for a small amount of air to enter. The breather at No. 1 cylinder was covered over and a pipe carried to the intake chamber of the scavenging pump. In this pipe line an oil separator was constructed which very effectively prevents the carrying over of oil from the crankcase to the air pump. This experiment has worked out in an excellent manner and resulted in no crankcase fumes whatever in the engine room and no discernible loss of lubricating oil, practically all of the oil pulled from the case being drained back from the oil separator.

Production by months from start of operation to date.



All of the water and oil piping other than the standard piping on the engine consisted of Type M copper tubing with sweat type fittings, a considerable amount of this piping being 4 in. and 5 in. for water lines, and smaller sizes for fuel and lubricating oil lines. Raw cooling water is taken from the Crow River adjacent to the plant, and, as the existing raw water pumps were of sufficient capacity, no changes were required in this part of the system.

No switchboard panel additions were required, since blank panels were provided for a fourth unit in the original construction. Four new General Electric GDA regulators were installed, however, and the existing General Electric Type TA regulator removed. In common with the older units, the new unit was provided with a chain driven exciter and, with the new system of regulation, parallel operation of the exciters is no longer required, putting a generator on or removing one from the line being considerably simpler and faster.

The accompanying chart reproduction illustrates graphically the rapid increase of load on the plant, and the part of the total output which was furnished to the REA lines served from the plant. As a consequence, the system revenue increased from $85,797 for the fiscal year ending March 31, 1938, to $105,998 for the year ending March 31, 1939, in spite of a rate reduction last December of approximately 5 per cent to all service classifications. The residential rate now is as follows:

Per month		*At*
First 40 kwh.	.....	5.5c. per kwh.
Next 60 kwh.	.....	3.5c. per kwh.
Next 250 kwh.	.....	2c. per kwh.
Over 350 kwh.	.....	1.5c. per kwh.
Minimum bill	.....	$1.05

Less 5 per cent discount for prompt payment.

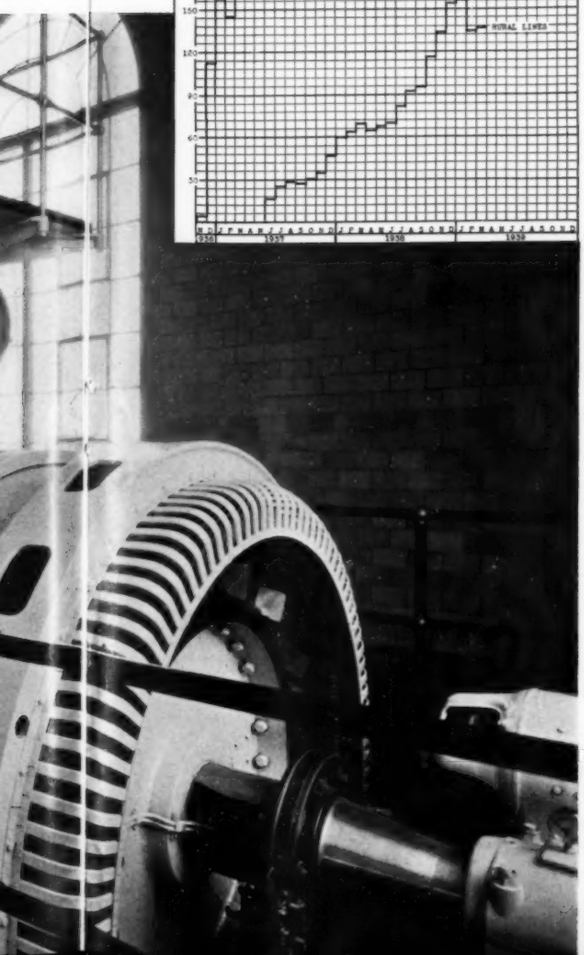
An off peak water heating rate of 1c. per kwh. net makes this service available to all customers at minimum cost and rate schedules applying to other customer classifications are in proportion to those quoted.

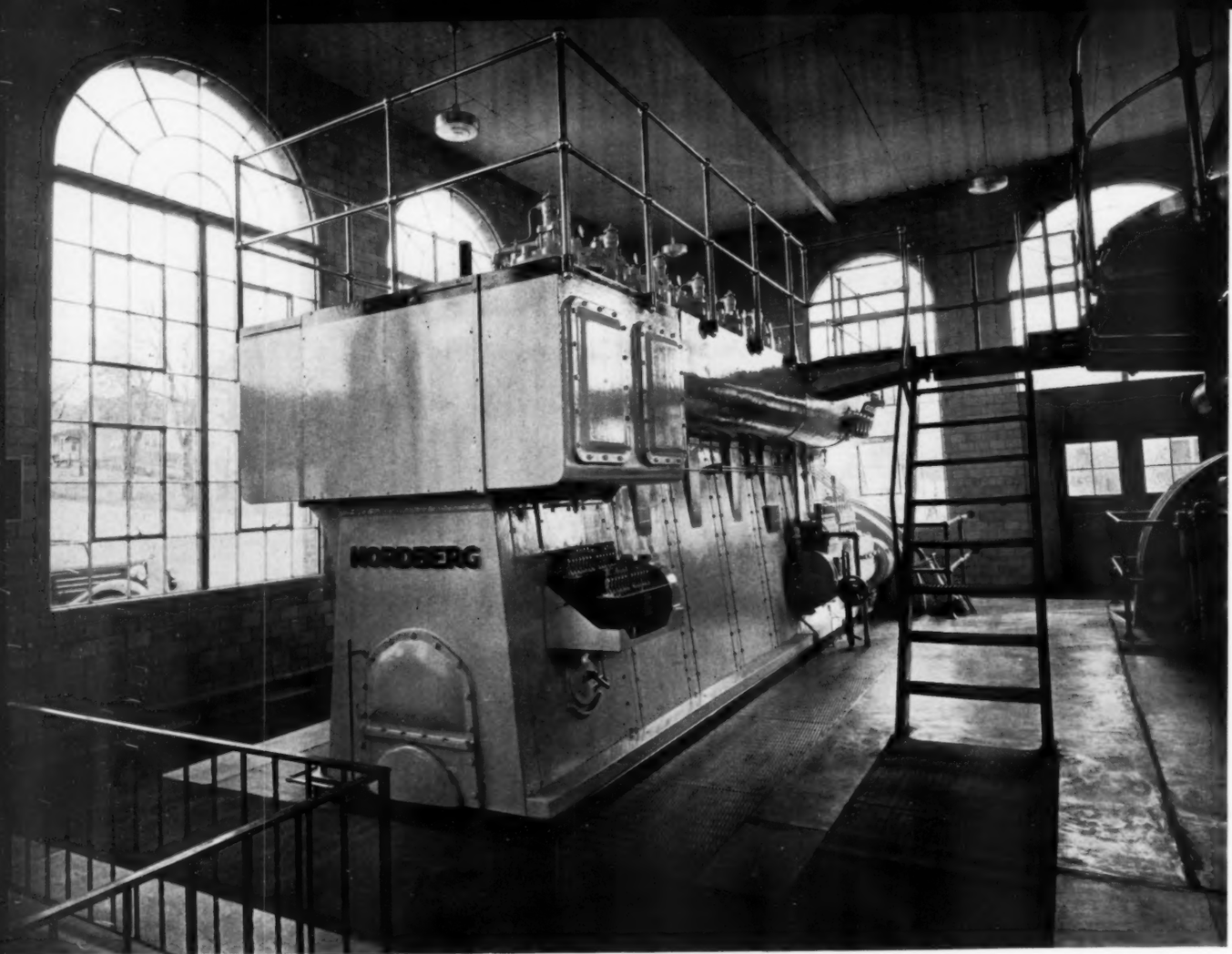
The population of Hutchinson has been increasing rather more than the general trend for small cities, but the principal reason for the rapidly increasing use is that fact that many ranges, refrigerators, water heaters, and similar major appliances have been added to the lines since the plant began operations, and load building efforts have been active at all times. The plant secured approximately 95 per cent of the business available at the time it began operation and, at the present time, this has increased to practically 100 per cent because there are only about a dozen customers remaining on the private competing company's lines.

A comparative statement covering the first two years of the plant's operation follows:

COMPARATIVE STATEMENT OF OPERATIONS
Years Ending March 31, 1938 and 1939

	Year Ending Mar. 31, 1938	*Year Ending Mar. 31, 1939*	*Increase or Decrease**
Sales	$89,533.22	$110,173.56	$20,640.34
Discounts and Allowances	3,736.24	4,175.12	438.88
Net Sales	85,796.98	105,998.44	20,201.46
Operating Expenses			
Plant	19,619.99	27,493.14	7,873.15
Distribution	6,807.50	7,853.59	1,046.09
Administrative and General	4,477.56	6,060.88	1,583.32
Total Operating Expenses Before Depreciation	30,905.05	41,407.61	10,502.56
Profit on Operations Before Depreciation	54,891.93	64,590.83	9,698.90
Less Depreciation	13,157.82	15,748.69	2,590.87
Net Profit on Operations	41,734.11	48,842.14	7 108.03
Plus Non-Operating Income	.00	98.30	98.03
Less Non-Operating Expense	9,898.59	9,508.28	390.31*
Net Income	31,835.52	39,432.16	7,596.64
Previous Surplus Balance	3,737.31	35,572.83	———
Surplus Balance	35,572.83	75,004.99	39,432.16





Another view of the 1,500 hp., six-cylinder Nordberg Diesel as installed in the Hutchinson, Minnesota, Municipal Diesel Plant.

Exterior of the enlarged Municipal Diesel Plant at Hutchinson, Minnesota, after the 1,500 hp. Nordberg had been installed.

Of the original plant indebtedness of $295,000, $92,000 has been retired to date (June, 1939), most of this being in advance of maturities, for some of the cancelled bonds are not due until 1951. A total of $84,000 worth of pledge orders were issued to cover the installation of the Nordberg unit, these being obligations on plant revenue only and bearing 3½ per cent interest.

A detailed report concerning plant activities is published at the close of each fiscal year, and copies of the Second Annual Report are still available on request.

J. Harry James, Wiggins, Colorado, is shown above starting one of his two Cummins Diesel-powered pumping units.

DIESELS MAKE IRRIGATION CHEAPER

By GEORGE D. CROSSLEY

THE farmers around Wiggins, a flat, treeless, sun-baked section of Colorado, tell a different story today than they did five years ago. Located about 100 miles north and east of Denver, this section of the country is really hot and dry in the summer. In most places as you walk down the dirt roads, powdery dust is so heavy that it "squooshes" out from underfoot like heavy snow-slush. The ground is rich though and needs only water to produce good crops. Ten or fifteen years ago, a man could get by farming dry. But according to one, after 1931 the land took all that was earned and more. B. D. Archer said, "In 1935, this farm wasn't worth a nickel . . . it wouldn't pay the interest on a dollar." One of C. Moser, Jr.'s six sons said, "Six years ago there was nothing growing on this land but cockleburrs."

Another typical comment came from Irving Jensen who said, "If it rained, we'd have a crop . . . if it didn't . . . well, we just prayed for rain."

About 1933, C. Moser, Jr., whose farm is just outside Platteville, Colorado, put down his own water well. A gas tractor was used for a while to run the Pomona Turbine pump but it was

This dependable and ample supply of water from a Diesel-powered pump makes possible the growing of alfalfa to feed the huge cattle herds owned by Western Ranchers, Inc., Crooks, Colorado.

pretty expensive. In the spring of 1934, Mr. Moser bought a Model HI 4-cylinder Cummins Diesel to run it. The well is 82 feet deep and 1,300 gallons of water a minute is being lifted from 50 feet to irrigate 65 acres. It is not uncommon for weather conditions to demand the engines continuous 24-hour operation for weeks at a time. One rainless siege in 1938 lasted from the 20th of May to the 8th of August, and would have completely burned up any semblance of a crop had it not been for an ample supply of water completely under Moser's control.

After four seasons' operation the engine was checked over for the first time! Valves were ground, new rings installed and the unit put back into service. Fuel consumption figures at a little less than two gallons per hour, and lube oil is changed every 150 hours, none being added between. Water from the local Lake Irrigation System costs about twice as much as the Diesel's operating costs. The Mosers also have no work to do in building and maintaining their own ditches from the system to their farm, and are not restricted in getting water when they need it. Flexibility in water supply is very important, because it is so hot that a delay of one or two days may be the difference between a good or a poor crop.

As you travel east on one of the main highways to Fort Morgan, Colorado, you can't help seeing the 4-cylinder Cummins unit owned by B. D. Archer of Wiggins, Colorado. Standing in a field, with no one near it for miles, the Diesel is running a Worthington pump equipped with a Johnson right-angle head. This direct-driven unit lifts a 10-in. column of water 65 ft. from a 150-ft. well, delivering 1,200 gpm. Capacity delivery is 1,700 gpm. Mr. Archer is irrigating 245 acres and raising sugar beets, beans, alfalfa, corn, wheat, barley and oats. It was Archer who said, "When I first came here this farm wouldn't pay the interest on a dollar. Last year (1938), I raised 1,000 tons of sugar beets on it."

Water is usually ditched for a mile and a quarter although some of the land irrigated is far as 1½ miles from the pump. The land has a good slope and not much water is lost.

"I first went to Diesel because the gas engine I had cost too much to run and didn't deliver enough power. All I could get with it was 400 gpm. The first day with the Diesel we got 900 gallons per minute and the well has come in better and better ever since."

This engine which has been working since the spring of 1936 has required no service work and according to Mr. Archer, "It's the least of my worries."

J. Harry James has two Diesel pump units, one located seven and the other nine miles southwest of Wiggins. The first was put in service in April, 1936, and the second in September, 1936. Both Diesels direct-drive Worthington pumps. The first lifts a 10-in. column of water 65 ft. from a 95-ft. well, delivering 1,400 gpm. to irrigate 240 acres. At one time, this unit ran for eleven weeks, 24 hours per day, and was stopped only for oil changes. It was irrigating 350 acres at the time.

The second unit, purchased after the first had proved its dependability, is a duplicate of the first. It now is lifting a 10-in. column of water from 60 ft., delivering 1,800 gallons per minute to irrigate 150 acres.

Mr. James is growing sugar beets, beans, corn, barley, and wheat. He has had no mechanical trouble with either engine. "What troubles we have had, a little from bad fuel, have been our own fault."

According to Mr. James, his Diesel water pumps have made possible an average yield increase of from 2½ to 3 times that with dry conditions. An average dry bean crop is four to five hundred pounds per acre. With water, this yield jumps to 1,200 to 1,800 pounds per acre depending on conditions beyond one's control, such as excessive heat, hail, grasshoppers, etc. Raising sugar beets, the most valuable crop, is impossible without plenty of water as it is essential that they be thoroughly watered about seven times before the harvest.

Mr. James has been farming here for 25 years, coming originally from South Carolina. During the winter he uses one of the pump engines as a feed grinder.

The only water that was to be found on Mr. James' first farm is at the low end of the field. This necessitated the use of a concrete reservoir which raises the water level a little over 6 ft. From here the water travels 2,200 ft. in a dike to the high end of the field and from there is distributed over the field.

Mr. James says, "If you use good fuel of a recognized brand and good lube oil, you can turn these Diesels loose and they will run forever. That's just the confidence I have in them."

The characteristics of the ground in this territory make it rather difficult to maintain the proper moisture content. Unlike sandy soils, this ground cracks from a foot to 18 in. deep, as soon as it drys on top, which causes the ground to dry out fast. Consequently, after each watering and after any sort of a rain the

ground must be reworked to keep a mulch on it.

Irving Jensen, it is said, was the first to drill his own water well in the Wiggins district. Using a 9-in. Peerless turbine pump, original power was taken with a flat belt from a tractor. This was soon abandoned for a 4-cylinder Cummins Diesel Model HI. The 85-ft. well now delivers an average of 1,000 gallons per minute to irrigate 155 acres. The Diesel uses half as many gallons of cheaper fuel and less than one-twelfth as much lube oil.

The Diesel, put in service in July, 1936, usually runs continuously for two months, starting some time in the middle of May. Mr. Jensen said, "It's a sure crop now. I can go to bed at night and forget about the engine running. It has never stopped of its own accord and I've never had any trouble with it."

O. C. McKnight & Son, just outside of Fort Morgan, Colorado, had a lot of trouble with the first engine they bought to power their pump. After checking every source for information (letters were even written to an extensive list of colleges), the field narrowed down. "And," said Mr. McKnight, "we bought our engine from the outfit that put their claims in writing."

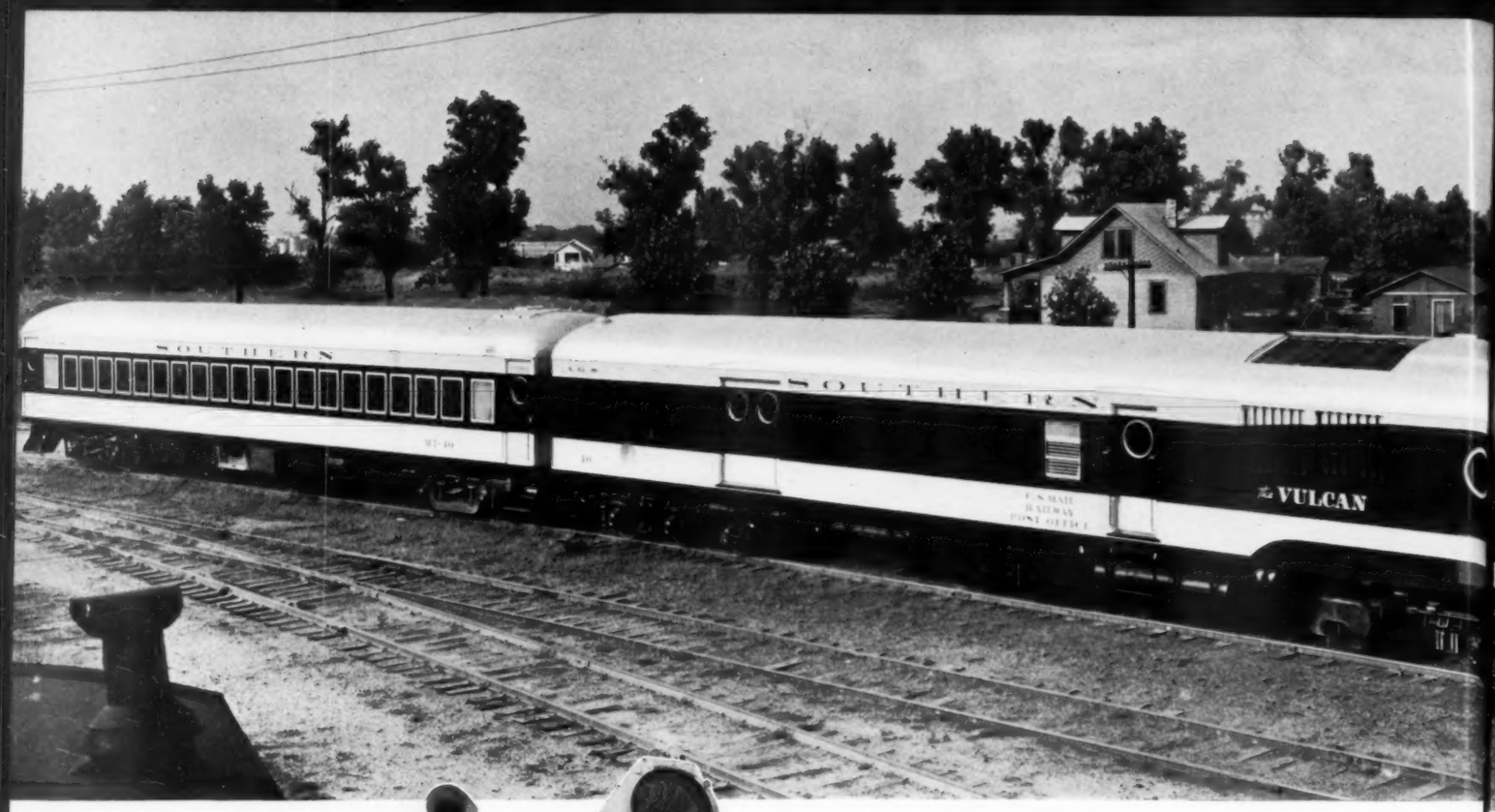
An HI 6-cylinder Cummins was installed July 10, 1936, and drives a Pomona Pump with four V belts. The pulley on the engine is 24-in. and the pulley on the pump 10 in. Well diameter is 16 in. and the bowl on the pump 14 in. The water, lifted 71 ft., is delivered at the rate of 1,600 gallons per minute to irrigate 120 acres of land. In 1936 the engine operated for 2,518 hours and in 1937 about 2,000 hours. Fuel consumption varies from 2½ to 3 gallons per hour. After these costs were established and the Diesel had proved its economy, further records were not kept.

Irving Jensen, first to put down his own well in Wiggins, Colorado, and one of the first to use a Diesel engine, stops for a refreshing drink.

During one season of 110 days the engine ran continuously, being stopped only for oil changes. "During these seasons when the engine must run constantly we only see it about twice every 24 hours. We have never had to make a special point of coming from the field to check it. And, Mr. McKnight concluded, "We have had no trouble with it at all."

There is no doubt that cheap water has been the salvation of these farmers as well as many others in this region operating similar Diesel-powered pumping units. Crops today, as good as any farmer can expect, have replaced the bitter experiences of seeing weeks of labor shrivel and burn from lack of water. Cheap water has given ground which had degenerated into useless wasteland a new value and a livelihood to its people.

Typical view of one of the vast, treeless fields prepared for planting and watering.



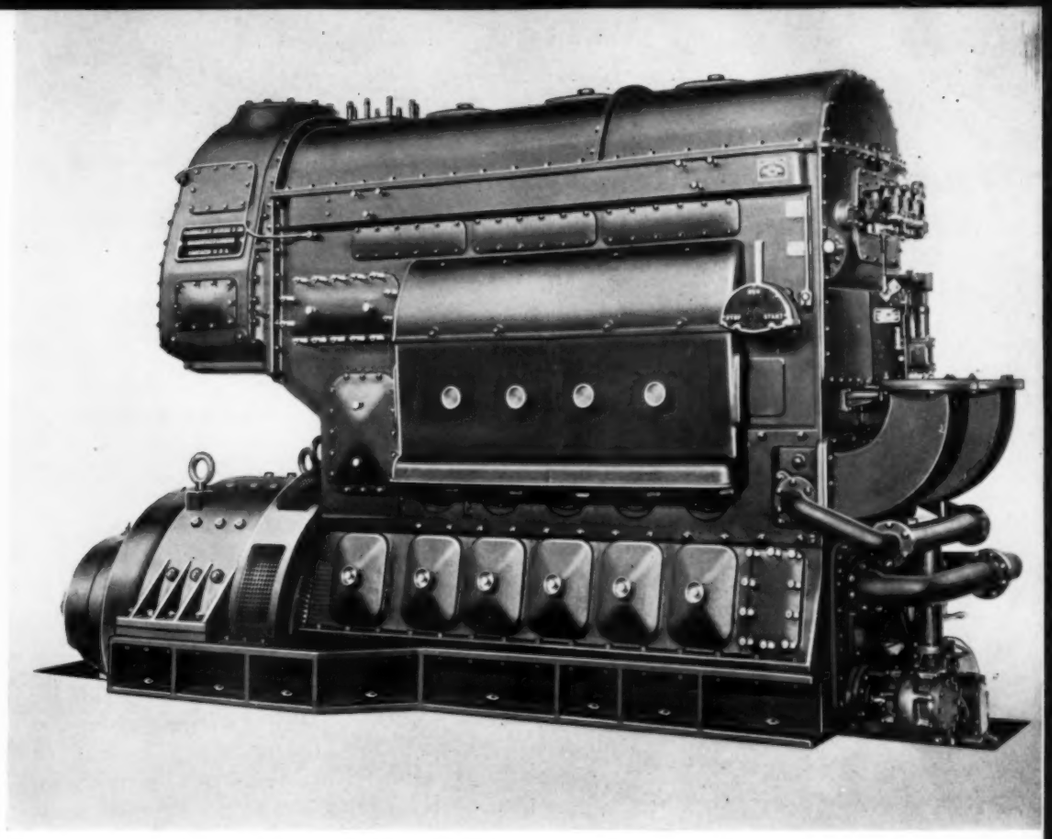
Southern Railway System is taking delivery of six of these Diesel-electric modern two car trains for local service.

NEW TWO CAR DI

By DWIGHT ROBISON

THE Southern Railway System is now taking delivery of six 2-car Diesel-electric trains from the St. Louis Car Company, these trains to be driven by Fairbanks-Morse opposed-piston Diesel engines with Westinghouse electrical equipment, are designed for use exclusively in local service. One train will be operated between Oakdale, Tennessee, and Tuscumbia, Alabama. Three trains will be operated between Chattanooga, Tennessee, Birmingham, Alabama; Mobile, Alabama; and Meridian, Mississippi. Two trains will be operated between Atlanta, Georgia, and Brunswick-Jesup, Georgia. The installation of this new equipment will release a total of six steam locomotives, six mail-apartment cars and ten coaches.

Each of the new 2-car trains, built for the most part of welded Cor-Ten high-tensile steel, is 152 ft. 9 in. long, weighs 342,880 lbs. and has the exterior attractively finished in a blending



Fairbanks-Morse developed this new opposed-piston two-cycle Diesel engine with generator for railway service.

DIESEL-ELECTRIC TRAINS

For Southern Railway System

of green and silver striped horizontally from front to rear.

The power car, equipped with an 800 hp. Diesel-electric power plant, is 80 ft. long over the end sills, including an engine room 26 ft. long and weighs 228,180 lbs. It includes a standard 15 ft. mail apartment, the remainder of the car, approximately 38 ft., being devoted to baggage storage. The leading truck of the motor car is a 4-wheel truck having 6½ in. by 12 in. journals and 36-in. rolled steel wheels. The rear truck is a 6-wheel truck having 5½ in. by 10 in. journals and 36 in. wheels. Two Westinghouse electric traction motors are installed in this truck, one on each of the two outside wheels. These trucks have Commonwealth cast steel frames, and Fafnir roller bearings.

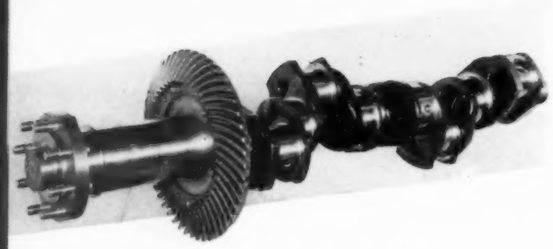
Each of the new coaches is 72 ft. 9 in. long over buffers, and weighs 114,700 lbs., with seating capacity for 76 passengers. The seats are of the reversible type, upholstered with plush and having wooden arm rests. Safety steam-jet air-conditioning equipment is installed, also Vapor steam heat, designed with floor heat and overhead heat to work in conjunction with the air conditioning system.

Going back to the power car, the Fairbanks-Morse opposed-piston Diesel engine, used in each of these six new two-car trains, is especially designed for railroad service. The engine has 5 cylinders with bore and stroke of 8″ x 10″ x 10″ with horsepower of 800 at continuous duty rating at 720 rpm. and 938 hp., maximum, 1 hour duty rating. The engine is of the two cycle, full Diesel, solid injection type. The general design of this 5-cylinder, 800 hp. F-M engine is characterized by having two pistons in each cylinder operating in opposite directions with a common combustion space formed by the heads of the pistons, thus eliminating all valves. In reality, therefore, with a pair of pistons in each cylinder, this 5-cylinder engine becomes a 10-cylinder Diesel because of this new design.

The upper pistons, controlling the scavenging air inlet ports, are connected to the upper crankshaft, and the lower pistons, controlling the exhaust ports, are connected to the lower crankshaft, these crankshafts being mechanically connected by means of a vertical shaft equipped with necessary bevel gears and a flexible coupling.

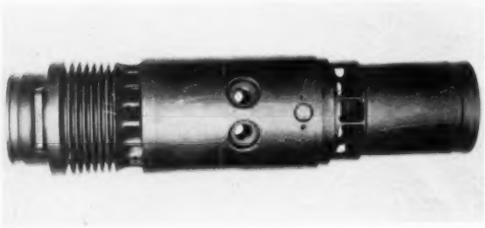
The engine is a complete self-contained unit with attached rotary type blower for supplying scavenging air and is equipped with all attached pumps and auxiliaries. Supercharging is obtained by giving a small lead to the lower crankshaft, thus closing the exhaust ports slightly ahead of the scavenging air ports which allows the manifold pressure to build up within the cylinder. The weight of the engine complete when dry is 19,500 pounds; with fuel, water and lubricating oil the weight is 19,800 pounds.

The enbloc engine and cylinder housing are of welded steel plate construction, forming a rigid unitary structure. Both crankshafts are

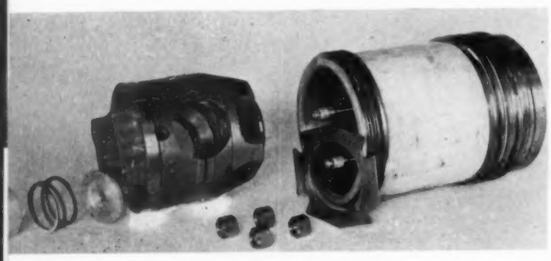


Lower crankshaft with generator coupling collar and studs, also spiral bevel gear through which the upper and lower crankshafts are connected.

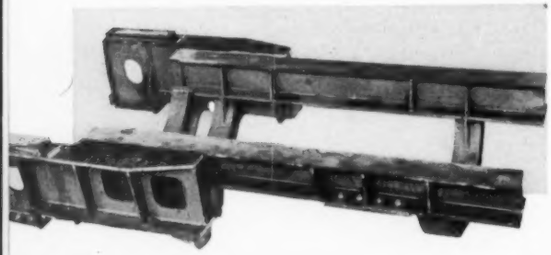
Opposed piston cylinder liner showing intake ports left and exhaust ports right.



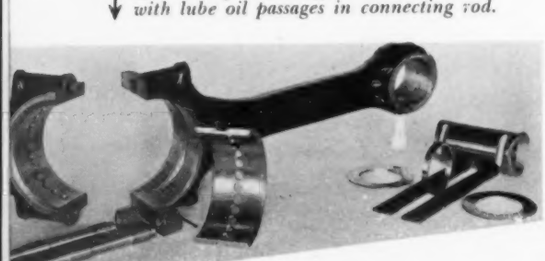
Pistons are trunk type. The wristpin is mounted within and attached to the piston by means of a removable plug type insert.



Welded steel plate Diesel engine cradle for power car.



Connecting rod and parts. Note removable crankpin bearings drilled to connect with lube oil passages in connecting rod.



supported in this unitary engine frame, the upper and lower oil pans of light weight construction being attached to the frame. A crankcase venting system is provided, whereby leakage exhaust gases are removed by means of the blower and are thus prevented from entering the engine room.

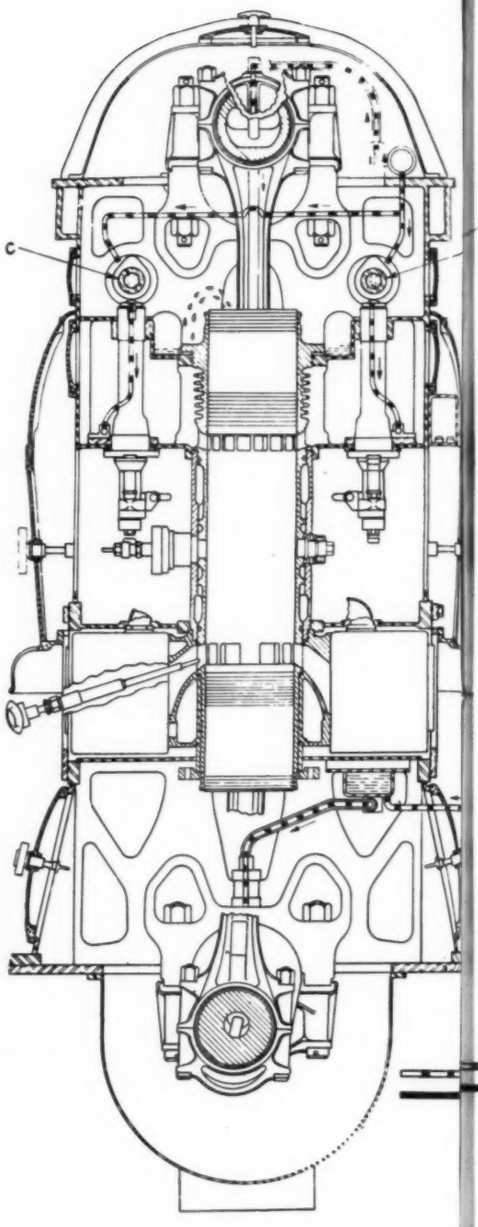
Both crankshafts are of hollow, cast-cored construction made from chrome-nickel-molybdenum alloy. The crankshaft diameter at all main bearings is equal to the diameter of the cylinder bore. This construction provides maximum strength with minimum weight. The bearing surfaces are turned and polished to provide a hard wearing surface. The shafts are drilled and fitted with tubes for lubricating oil transfer passages. Connecting rods are one-piece steel forgings fitted with removable liners for wristpin bearings and removable shells for crankpin bearings. Crankpin bearings are lined with centrifugally cast white metal and connecting rods are drilled to provide lubricating oil passages.

The scavenging air blower is of the multiple spiral lobe positive displacement type, driven from the upper crankshaft by means of helical gears. The relative timing of the impellers is positively maintained by precision gearing. Exhaust headers are water cooled and renewable without major dis-assembling and are interchangeable on right- and left-hand engines.

The governor is of the fly-ball type and operates indirectly on the injection pump plungers to control the quantity of fuel by varying the opening of a by-pass in the injection pump cylinder. Provision is made for setting the governor to regulate the engine speed to meet the requirements of the control equipment. An overspeed governor is provided and is set to cut off the fuel supply when the engine speed exceeds maximum by seven per cent. A hand throttle is provided.

The engine is fitted with a rotary type fuel supply pump, which delivers fuel from the service tank through attached Purolator duplex filters, to the suction side of the injection pumps, maintaining a constant pressure on each injection pump. Each cylinder is fitted with individual fuel measuring injection pumps, and individual differential type injecton nozzles.

Each engine is fitted with a centrifugal water pump, to circulate water through the engine system and radiator for cooling the liners and combustion spaces. Piston cooling oil is delivered by a gear type pump, through the main



bearings, crankshaft and drilled connecting rod, then around the piston pin bushing, into the piston cavities.

Two built-in gear type lubricating oil pumps are used. One circulates the oil from the sump tank through a De Luxe duplex oil strainer and the oil cooling radiator and back to the cool oil pump. The other oil pump circulates the cool oil through the piston cooling cavities by means of passages in the main bearings, crankshaft, connecting rods and pistons,

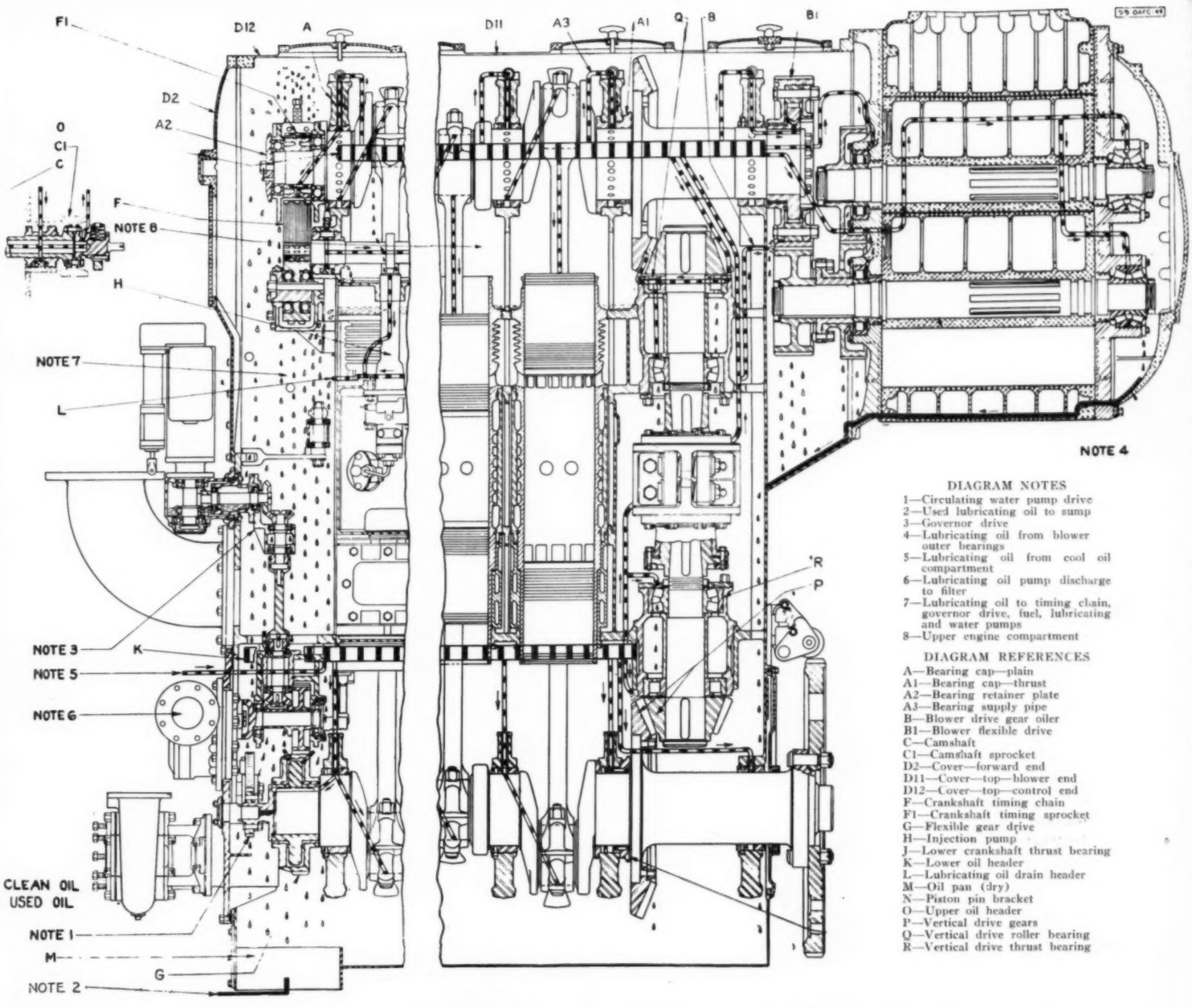


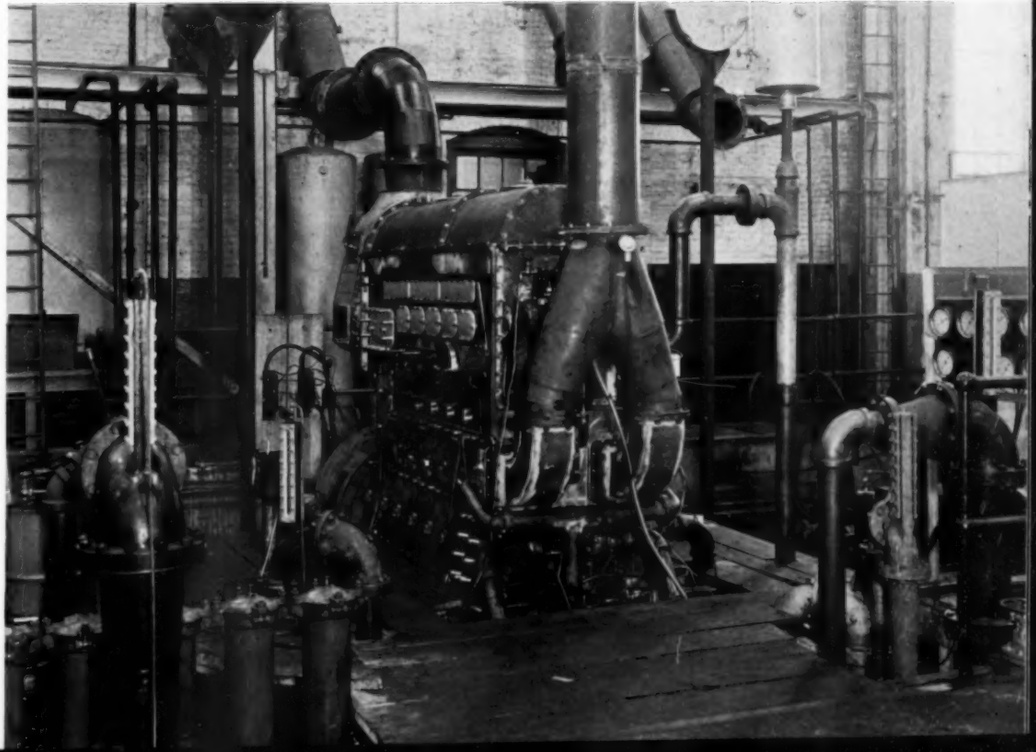
DIAGRAM NOTES

1—Circulating water pump drive
2—Used lubricating oil to sump
3—Governor drive
4—Lubricating oil from blower outer bearings
5—Lubricating oil from cool oil compartment
6—Lubricating oil pump discharge to filter
7—Lubricating oil to timing chain, governor drive, fuel, lubricating and water pumps
8—Upper engine compartment

DIAGRAM REFERENCES

A—Bearing cap—plain
A1—Bearing cap—thrust
A2—Bearing retainer plate
A3—Bearing supply pipe
B—Blower drive gear oiler
B1—Blower flexible drive
C—Camshaft
C1—Camshaft sprocket
D2—Cover—forward end
D11—Cover—top—blower end
D12—Cover—top—control end
F—Crankshaft timing chain
F1—Crankshaft timing sprocket
G—Flexible gear drive
H—Injection pump
J—Lower crankshaft thrust bearing
K—Lower oil header
L—Lubricating oil drain header
M—Oil pan (dry)
N—Piston pin bracket
O—Upper oil header
P—Vertical drive gears
Q—Vertical drive roller bearing
R—Vertical drive thrust bearing

Above, end and side sections of Fairbanks-Morse railway Diesel showing arrangement of opposed pistons, scavenging air blower, and lube oil passages. Below—Shop view showing the new F-M Diesel under test before installation in the power car.



and provides positive pressure lubrication at all times for all bearings. The pump is of sufficient capacity to serve its own engine and generator continuously at full rated power.

The engine exhaust silencers and air intake cleaners and silencers are Burgess. Other engine accessories include Alnor pyrometer, Weston electric tachometer, Woodward governor, Modine lube oil coolers and water radiators, and U. S. Gauge distant reading jacket water thermometers.

CALVERT CONVERSION

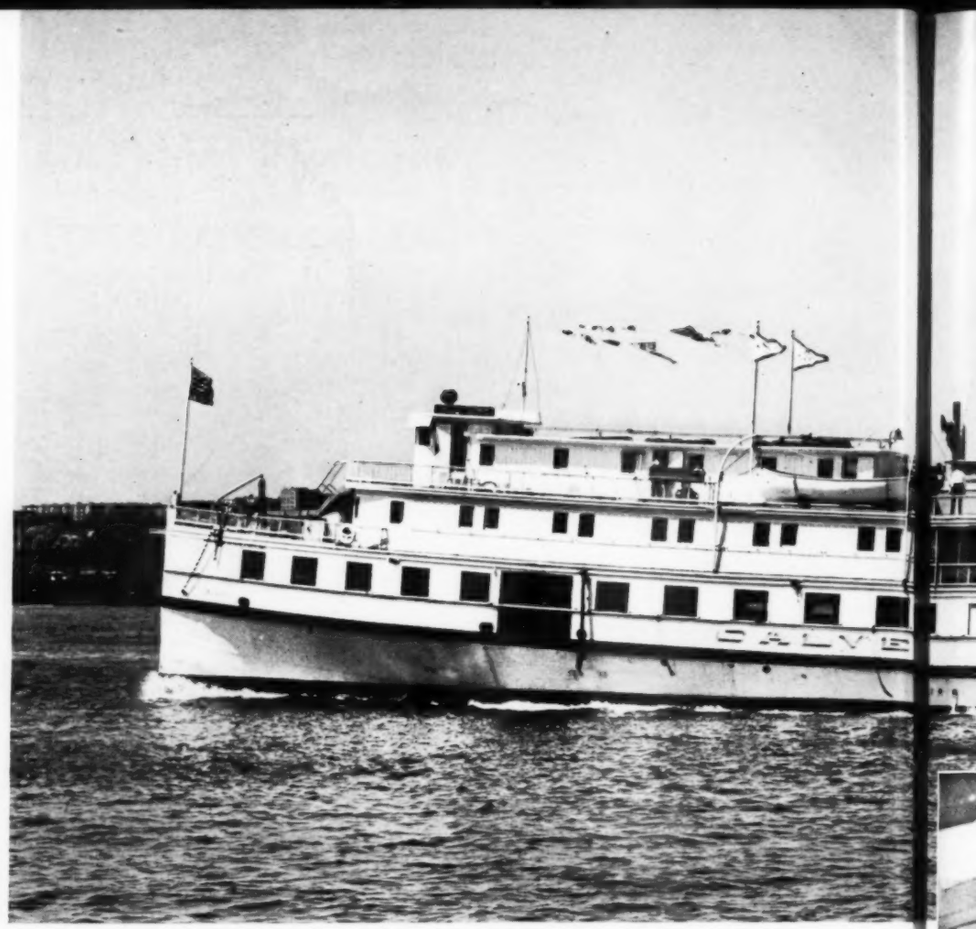
Saves owners over $1,400 per month

AN outstanding example of marine Diesel economy was furnished recently by the excursion and packet ship *Calvert* after conversion from steam propulsion. Diesel engines have many advantages over other types of marine drive but their remarkable economy is, by far, the most important consideration. This particular vessel affords an excellent opportunity for a comparison of steam and Diesel operating costs under similar circumstances and in the same hull.

Although the original steam engine was rated at 800 hp. and undoubtedly delivered that when first installed, indicator cards taken previous to the conversion showed only 679 ihp. being developed. Since this was sufficient power for speed requirements, a 600 hp. Atlas Imperial Diesel engine was selected for replacement. Fuel costs, that had totaled $1,700.00 per month for coal, dropped to the amazing figure of only $525.00 for fuel oil for comparable service and hours of operation. Additional savings in reduction of necessary personnel amounted to $300.00 monthly, *reducing the total operating expense by $1,475.00 every thirty days.* Obviously, the decision of the owners in regard to their Atlas Diesel was not difficult to reach on the basis of such figures. Subsequent operation has more than justified their judgment.

Before discussing details of this interesting conversion, a brief general description of the vessel and her history will enable the reader to visualize the problems confronting her new owners and those responsible for her modernization. The *Calvert* was built in Philadelphia, in 1902, as a passenger ship of 890 gross tons. She measures 200 ft. l.o.a. with a 40 ft. beam and a depth of 10 ft. 3 in. She was operated previously by the Pennsylvania Railroad Company in Chesapeake Bay service. Although relatively old in years, the *Calvert* is exceptionally well preserved, and the chief problem of her new owners, the Sound Steamship Lines, Inc., centered about improving her machinery for satisfactory operating efficiency. Not only was the old steam equipment expensive from the standpoint of fuel consumed, but it had reached a point where excessive maintenance charges also justified its removal.

Due to the unusually wide beam, it was possible to install the new main propulsion Diesel with all auxiliaries, including fuel, air and water tanks plus two 25 kw., 125 volt, Star Electric Company generators entirely within the existing engine room, leaving the space previously occupied by the boilers available for other purposes. A six-cylinder, four-cycle Hercules Diesel drives one of the auxiliary generators for stand-by service in port. The other is connected by V-belts to the main propeller shaft and is a variable speed, direct current machine for use while under way. Electric power for service and lighting requirements is furnished through a 300 ampere-hour, 110 volt Titan lead battery floating on the generator lines, which provides a steady flow of current regardless of fluctuations in main engine speed or changeover from one generator to the other to suit operating conditions. Carbon pile regulators insure constant voltage regardless of propeller shaft speed fluctuation.



After 38 years of passenger service in Chesapeake Bay the "Calvert" received a new lease on life in the form of an Atlas Imperial main propulsion Diesel engine. She now enters the Long Island Sound service with fuel costs reduced by approximately 60 per cent.

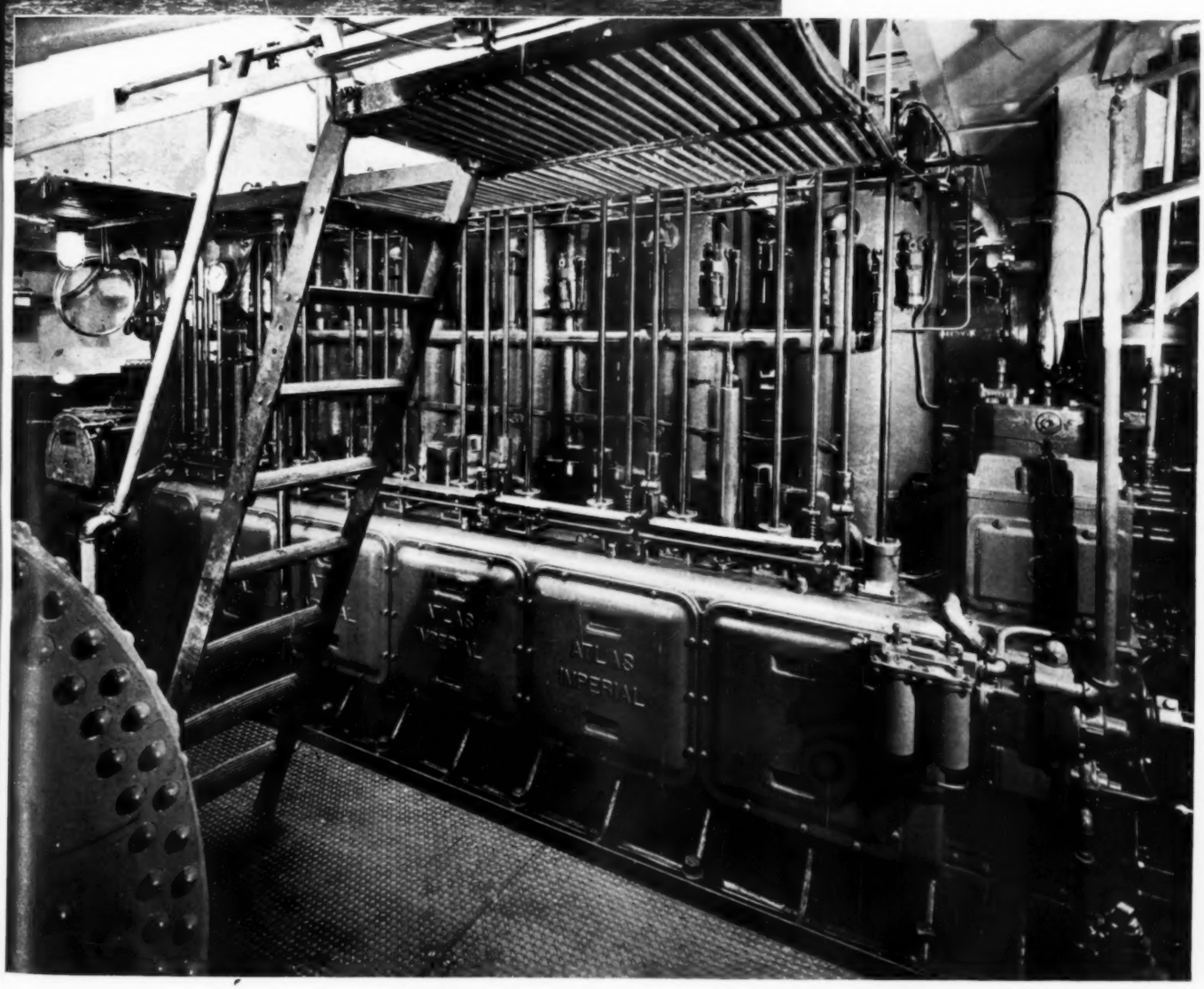
Control side of the 600 hp. Atlas engine which is the first marine Diesel to enter passenger and packet freight service between New York and New England ports.

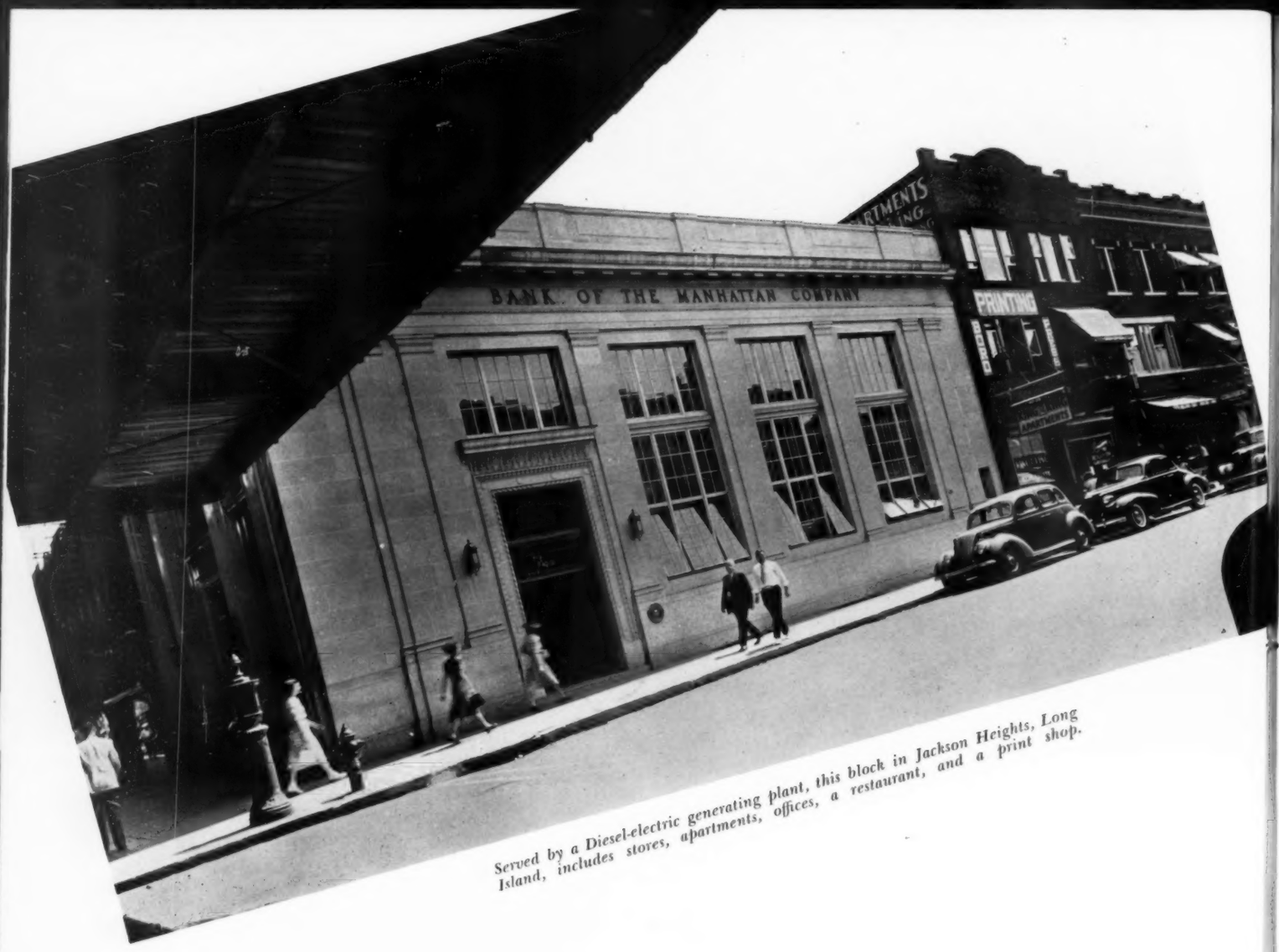
As previously stated, the new main propulsion engine is a 600 hp., four-cycle, solid injection Atlas Imperial Diesel with a 15 in. bore and 19 in. stroke operating at 300 rpm. and directly connected to a three-blade Ferguson propeller through a Kingsbury thrust bearing. The unit is direct reversing and is maneuvered by a single lever that controls both the direction of rotation and speed variation from 65 to 300 rpm. A speed of more than 11 knots was attained on trials with plenty of power in reserve. It is a typical slow-speed, heavy-duty engine of the type that has been installed so successfully in all classes of commercial service on both coasts. Engine-mounted auxiliaries include a built-in, 2-stage air compressor, Purolator fuel oil filter and Schutte-Koerting lubricating oil cooler. A Condenser Service and Engineering heat exchanger supplies fresh water cooling. A six-point Alnor exhaust temperature pyrometer for the main engine and Maxim silencers for both main and auxiliary Diesels complete the list of engine auxiliaries. Lubricating oil reclamation is handled by a Youngstown Miller purifier and a separate motor-driven Curtiss air compressor is available for emergency starting. While some ship auxiliaries were retained and motorized, the steam steering engine was replaced by an American Engineering Company electric-hydraulic steering gear. Outside of the engine room little change was necessary since the ship will continue in passenger and packet freight service for which she was originally designed.

Although marine Diesel engines have been used to power almost every conceivable type of vessel, the *Calvert* is the first ship of this kind and size to ply Long Island Sound with other than steam propulsion. For this reason, her record in comparison with competitors will be watched carefully and should be most interesting to a number of owners on the basis of preliminary figures to date. In addition to the saving of over 60 per cent in fuel costs alone and the elimination of wages for two firemen, a number of other important advantages accrue to the *Calvert* because of her conversion. Substantial reduction in engine room maintenance has already been mentioned and other savings

will manifest themselves during subsequent service operation. The ship will be a great deal cleaner and more comfortable for passengers and crew; considerably less time will be required for bunkering and at considerably less frequent intervals, and full power is now instantly available at any time from a cold start without the previous waste of fuel and time for getting up steam.

The entire expense of modernizing this ship will be paid out of savings in a few seasons of operation, after which the substantial difference in cost between steam and Diesel propulsion will be clear profit for her owners. The *Calvert* is not particularly a romantic nor arresting type of ship compared with recent Diesel yachts or streamline ferries, but she illustrates conclusively the tremendous opportunities for profitable modernization and operation of many existing commercial vessels through the utilization of dependable and economical marine Diesel engines.





Served by a Diesel-electric generating plant, this block in Jackson Heights, Long Island, includes stores, apartments, offices, a restaurant, and a print shop.

A REALTOR'S UTILITY PLANT

By CECIL P. MOLYNEUX

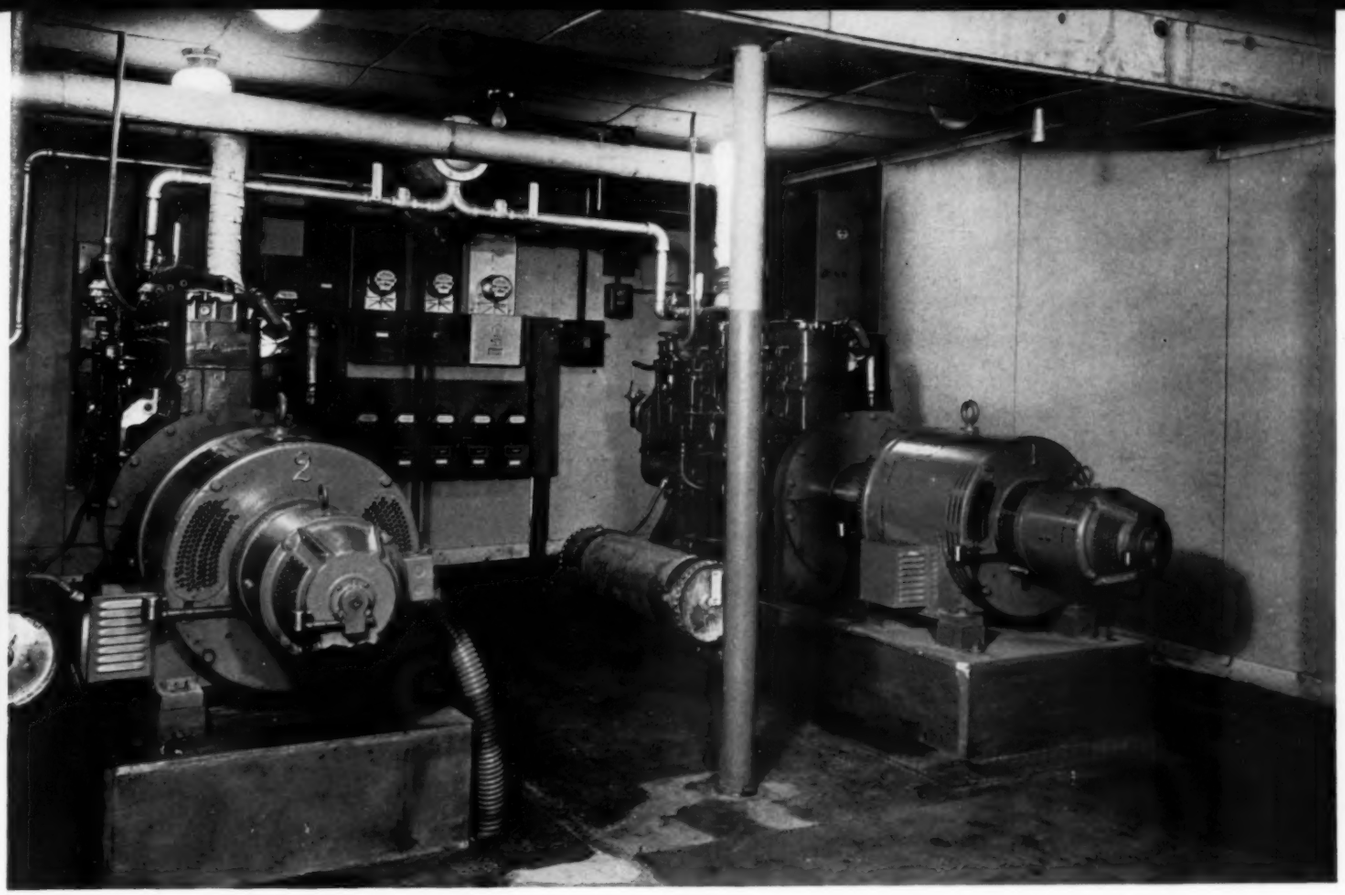
MR. VINCENT SCUDERI, president of the Duce Realty Corp. of Jackson Heights, Long Island, is one of the pioneer builders of this locality and has developed properties which were formerly marshland. He was one of the first to build air-conditioned houses and now he is the first to install his own utility Diesel plant in this district. The property, where this plant is installed, fronts on Roosevelt Avenue, Jackson Heights, Long Island, and consists of twenty-three stores, a large restaurant, a print shop, thirty apartments and six office suites.

Current is metered to the tenants at the same rate as the Utility Company with a discount of 10 per cent for cash payment. Needless to say, the tenants avail themselves of the discount and thus save a collection problem for the landlord.

The Diesel plant consists of two Cummins, type H6, 85 hp. Diesel engines directly connected to Star alternators of 40 kw., 1,200 rpm., three-phase type. Each engine governor is equipped with automatic frequency controls consisting of an electric gearmotor connected to the governor linkage which is actuated through relays from the Western Union time service. The electric clocks throughout the building keep perfect time by this system.

The engines are equipped with Leece-Neville electric starting motors, Cuno fuel oil filters, Skinner lube oil filters, and Donaldson twin intake air silencers and filters. Lube oil is Texas Ursa and Petrol supplies the fuel oil.

Domestic hot water is obtained by circulating the engine jacket water through a Sims Heat Exchanger and storing the heated city water in a 300-gallon tank. Should the demand for hot water exceed the engine capacity, a Petro boiler-burner unit automatically goes into action and brings the domestic hot water up to 140 degrees. A Rome-Turney radiator with a motor-driven fan is used to dissipate excess



Except for manual starting, these Diesel generating sets are equipped to operate continuously under protection of automatic devices.

jacket water heat when there is no demand from the heat exchanger. The fan is controlled by a Detroit water temperature switch so that it does not run when the heat exchanger demand is high. With this arrangement, thermostatically operated water valves are unnecessary and the engine temperature is kept within close limits.

Each engine exhaust is equipped with a Burgess, Snubber type, silencer and piped up to the building smokestack. These exhaust silencers do an excellent job as there is no noise or vibration even on the floor directly above the silencers so that no special soundproofing is necessary.

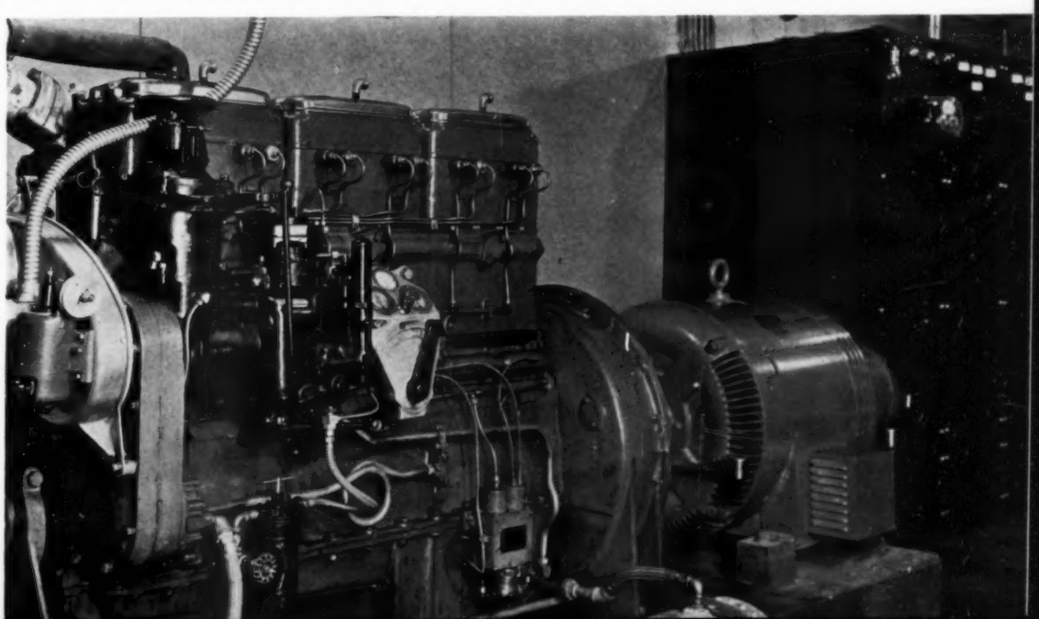
The switchboard was built by the Furst Electric Company and is of steel "dead front" type and all instruments are flush type Hickok meters. All of the meters for the tenants are installed on a rack in the engine room which facilitates monthly billing and makes them accessible for test purposes.

An original method was used to isolate the engine vibration. The usual method in using cork for isolating the engine foundation was to provide natural cork blocks of sufficient area and loading to support the weight of the engine, generator, and foundation block and filling in the intervening space with corkboard. This method is only partially effective since it was found that the corkboard carried part of the load thus reducing to a great extent the value of the natural cork blocks which depend on a loading of at least 2,600 lbs. per sq. ft. for their action. To overcome this defect, the following method of isolation was tried on this installation:

Natural cork blocks of correct area were placed on the bottom of the foundation pit, then instead of filling the intervening space with corkboard, a sheet of 10 gauge steel, having an area equal to the engine block, was placed on top of the blocks. The concrete forms were then built on top of the plate and the concrete poured, resulting in an engine block isolated and supported solely by the cork blocks, with air spaces under the engine block. This method of construction resulted in complete isolation and the results are very gratifying. The cost is no greater than the old method of cork isolation.

The entire plant was designed and installed by the Furst Electric Company during July, 1938.

Close-up of Cummins Diesel and Star alternator. The voltage regulator built into the generator is fully automatic. Note automatic frequency control motor linked to governor arm.



DIESEL AVIATION

TWO-CYCLE IN FRANCE

By PAUL H. WILKINSON

The sixteen-cylinder Botali-Rexovic Diesel from which the new four-cylinder 100 hp. Botali engine has been developed.

ALTHOUGH a good deal of the Diesel aircraft engine development in France has been devoted to four-cycle engines such as the Clerget and the Jalbert-Loire, there has been a growing tendency to turn to two-cycle engines. This is evidenced by the developments of Botali, Rochefort, Coatalen, Delafontaine and C.L.M. which are reaching the stage where flight tests of their engines will soon commence.

The new Botali Diesel is a small four-cylinder, air-cooled engine with its cylinders in X formation. It has a bore and stroke of 4.33 in. and a displacement of 510 cu. in. Its compression ratio is 16 : 1, and it is equipped with piston-type compressors for scavenging, giving an air-to-displacement ratio of 1.4 : 1. The engine develops 100 hp. at 1,850 rpm. and has a maximum output of 118 hp. at 2,000 rpm. at sea-level. As it weighs 260 lb., it has the rather high specific weight of 2.20 lb. per hp.

This new engine which is intended for sport planes, was developed from an earlier engine known as the Botali-Rexovic which had sixteen cylinders arranged in tandem pairs and eight displacer-type compressors to supply the scavenging air. A photograph and a sectional view of this engine accompany this article. It will be noted that this design utilized twin cylinders with a common combustion chamber somewhat similar to those in the Salmson SH 18 Diesel. There is a difference, however, in that the Botali pistons had deflectors on their crowns and operated in unison, i.e., one piston did not have a slight lead over the other one. The fuel injection system comprised a multi-cylinder Bosch pump connected to hydraulically-operated injectors located in the center of each combustion chamber. The fuel was injected at a pressure of 2,150 lb. per sq. in.

The earlier Botali-Rexovic Diesel with which some flying was done, had a bore and stroke of 4.33 in. and a displacement of 1,020 cu. in. It was rated at 350 hp. at 2,000 rpm. and had a maximum output of 380 hp. at 2,100 rpm. for take-off. The compression ratio of this engine was 15 : 1. It weighed 772 lb., or 2.04 lb. per horsepower.

The Rochefort Diesel is somewhat reminiscent of the Junkers Jumo 205 in that it has six vertical cylinders with opposed pistons and two crankshafts connected with spur gears. It will be noticed, however, that the system of ports is different inasmuch as there is a positively-operated sleeve valve encircling the lower end of the cylinder liner whereby an auxiliary set of ports just above the inlet ports can be controlled.

Referring to the sectional drawing of the Rockefort Diesel, it will be seen that the exhaust ports are at the upper end of cylinder liner and the inlet ports are at its lower end. The auxiliary ports referred to, are connected to regulating chambers along each side of the cylinder bank. Between the auxiliary ports and the regulating chambers, there are small valves or shutters to regulate the quantity of air which is permitted to escape from the cylinder bore. In this way, it is possible to regulate the air charge in the cylinder so that the engine may be underfed, normally fed or supercharged to an appreciable extent.

This method of controlling the density of the air charge in the cylinder is of particular value for aircraft engines inasmuch as it enables the density to be maintained constant at whatever altitude the engine is operating. Thus excess air at sea-level can be avoided, while the operation of the engine with full air charge at high altitudes is not impaired.

The auxiliary ports are not closed by the sleeve valve until after they have been covered by the fast moving piston toward the middle of its compression stroke. This high-speed valve action is advantageous in that it permits close regulation of the density of the air charge and equalizes the density in all the cylinders to a predetermined value. The auxiliary ports remain closed during the effective part of the compression stroke and they are not uncovered until the commencement of the next compression stroke.

Scavenging of the exhaust gases and the normal feeding of fresh air into the cylinders, are accomplished by means of a current of cold air from a low-pressure fan at the front of the

DIESEL AIRCRAFT ENGINE DEVELOPMENT

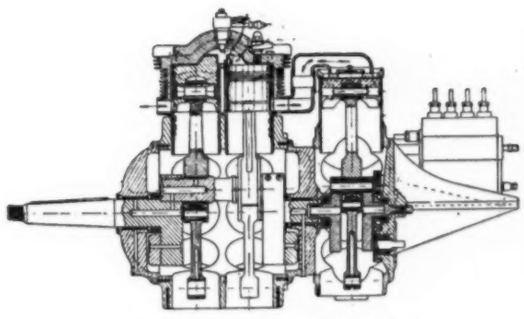
engine. The fan is located in a tunnel where it is driven by means of a drive shaft from the lower crankshaft through a free-wheel or over-riding clutch. Inasmuch as the fan blades are of helical shape, it is possible for the fan to be driven by air pressure at a speed equal to or greater than that at which it is driven by the engine. Thus the fan absorbs power directly proportionate to the resistance offered to it and maintains a substantially uniform rate of air flow.

For satisfactory operation, it is obvious that the fan must have a normal output sufficient to ensure complete scavenging of the exhaust gases and the filling of the cylinders with their air charge. With this particular type of engine, however, it is also essential that there should be an additional current of air available for circulating around the exhaust outlets. The latter are arranged diametrically-opposite to each other on each side of the cylinder bank.

Although they do not show on the drawing, the exhaust gases are expelled through expansion-type nozzles which are surrounded by venturi-shaped conduits through which a steady flow of air is maintained by the fan. This constitutes an ejector device for each exhaust outlet whereby violent acceleration of the air current is caused at the moment of release of the exhaust gases from the exhaust ports. The violent blasts of relatively cold air around the expansion nozzle tend to aid the evacuation of the exhaust gases from the cylinders and reduce the pressure and temperature of the gases themselves.

In its present form, the Rochefort Diesel is a comparatively small engine with a bore and stroke of 3.94 in. and a displacement of 571 cu. in. Its low stroke-to-bore ratio is advantageous for high-speed operation, however, and it is claimed that it can run up to 4,000 rpm. At this speed, its power output should be in the neighborhood of 350 hp., giving it a b.m.e.p. of 122 lb. per sq. in. The tests of this new engine with its many novel features, will be followed with great interest.

Coatalen, in the course of his development work, found that by changing from four-cycle to two-cycle operation, considerable improvement in the performance of his Diesel aircraft engine could be obtained. Since the brake horsepower output curve of his four-cycle 12 Vrs 2 engine indicated 700 hp. at 3,000 rpm., it is reasonable to assume that this power could be increased to at least 1,000 hp. with two-cycle operation. Add to this such improvements as more efficient valve-porting and the use of an exhaust-driven supercharger, and it is apparent that an output of 1,200 hp. is well within the realm of possibility without increasing the cylinder displacement. The last mentioned figure is stated by Coatalen as being his aim with his new two-cycle development.

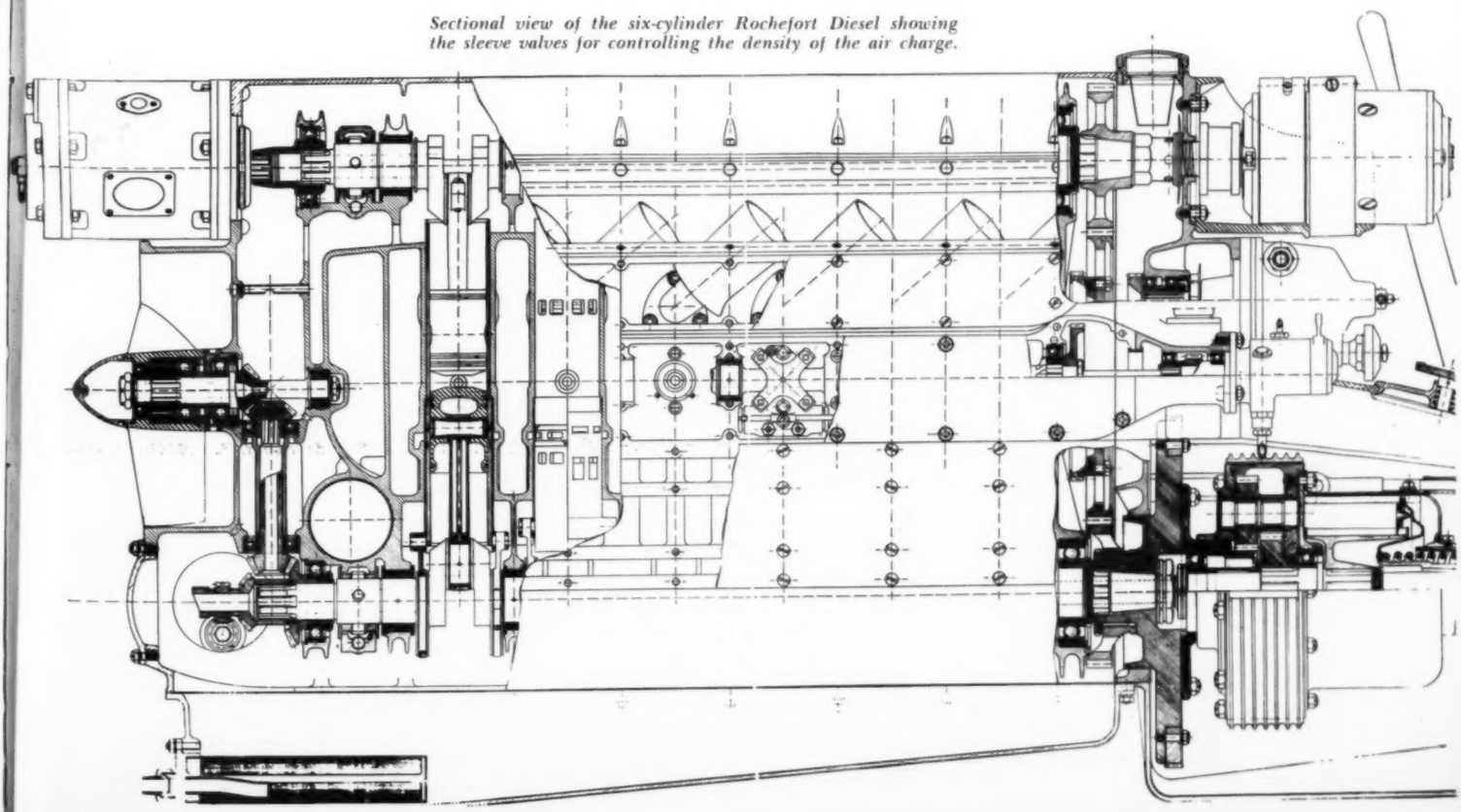


Sectional view of the Botali-Rexovic Diesel showing the common combustion chamber for each pair of cylinders.

Another designer in France who is partial to two-cycle Diesel aircraft engines, is to be found in Delafontaine who is developing a seven-cylinder, air-cooled radial. This engine is expected to give 400 hp. at a rated altitude of 12,000 ft. and it is equipped with a single-speed Farman gear-driven supercharger.

C.L.M. (Compagnie Lilloise de Moteurs) have had considerable success with their opposed-piston Diesels and it is quite possible that they may soon bring out something sensational in the aircraft engine field. So far, they have built a number of 150 hp., 250 hp. and 500 hp. automotive and railcar engines with four, six and eight in-line cylinders respectively. These engines have proved to be very satisfactory.

Sectional view of the six-cylinder Rochefort Diesel showing the sleeve valves for controlling the density of the air charge.



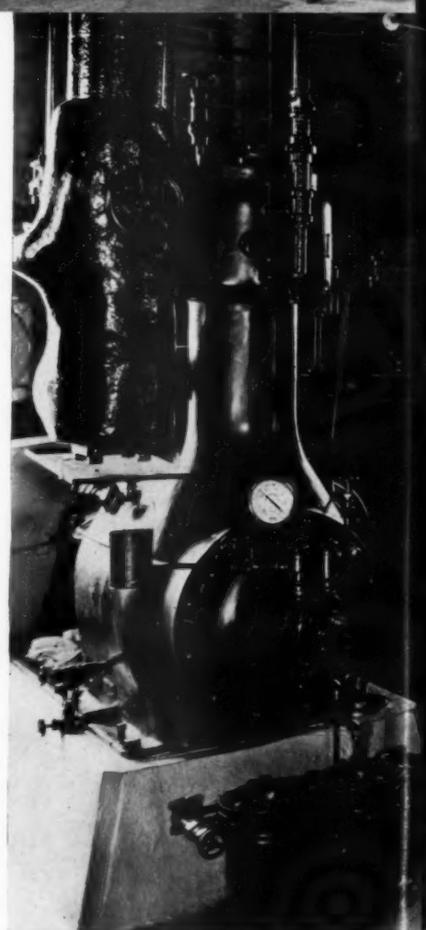
A Diesel-electric generating plant serves this large block including a sports arena, ice plant, offices, stores, and garage.

THE ARENA COMPANY

By WILBUR W. YOUNG

UPON the completion of one year's operation with Diesel generated electricity and Diesel driven ice machinery, the Arena Company and Arena Ice Plant of New Haven, Connecticut, have realized savings close to $8,000 by comparison with the previous cost of purchased power. This enterprise consists of a sports arena with seating capacity of 6,500 and a sixty-six ton ice plant housed in the same building. An unusual feature of this operation is the fact that the Diesel engines are installed on the second floor of the ice plant which connects with the arena. Two Chicago Pneumatic, six cylinder, 8 in. bore, 10 in. stroke, 180 hp. Diesels running at 600 rpm. drive two Westinghouse 100 kw. generators at 1,200 rpm. through 2 : 1 ratio Morse Chain drives from the engine shaft extensions. From the same shaft extensions which are carried in outboard bearings, the engines drive two York ammonia compressors, also through Morse Chain drives. The drives are arranged for simultaneous operation of both generators and compressors or for independent operation of either generator or compressors.

Accessories, identical on both engines, include Nugent fuel oil filters, Cuno lube oil filters, Harrison Radiator lube oil coolers, Pickering governors, Burgess intake silencers, and cleaners, Maxim exhaust silencers, U. S. Gauge jacket water thermometers, and Detroit-250 control switches covering lube oil and water temperature alarms, Bosch injection systems and American Hammered Piston rings. A six point Alnor exhaust pyrometer is connected to both engines. Starting air is supplied at 300 lbs. to two storage bottles by a Novo gas engine driven Curtis compressor. A Binks atmospheric cooling tower handles the Diesel jacket



water cooling. The switchboard instruments and switchgear are Roller-Smith, the voltage regulator a Simplex, while the distributing and totalizing panel is a Trumbull, which is equipped with two General Electrc watthour meters.

The smooth, quiet operation of these Diesel engines is attested to by the fact that their presence can neither be felt nor heard in parts of the building adjacent to the second story engine room. This is important because the building is occupied by stores and offices wherein noises and vibration would constitute an annoyance.

In addition to supplying refrigeration for the ice plant, it is frequently necessary for this equipment to handle the freezing of a large skating rink on the floor of the arena, as well as to carry a heavy lighting load. Top demand reaches 130 kw. with the normal daily load averaging 70 kw.

The following figures show conclusively the economy of this Diesel installation, which, by the way, is operating under a rather unique combination of loads:

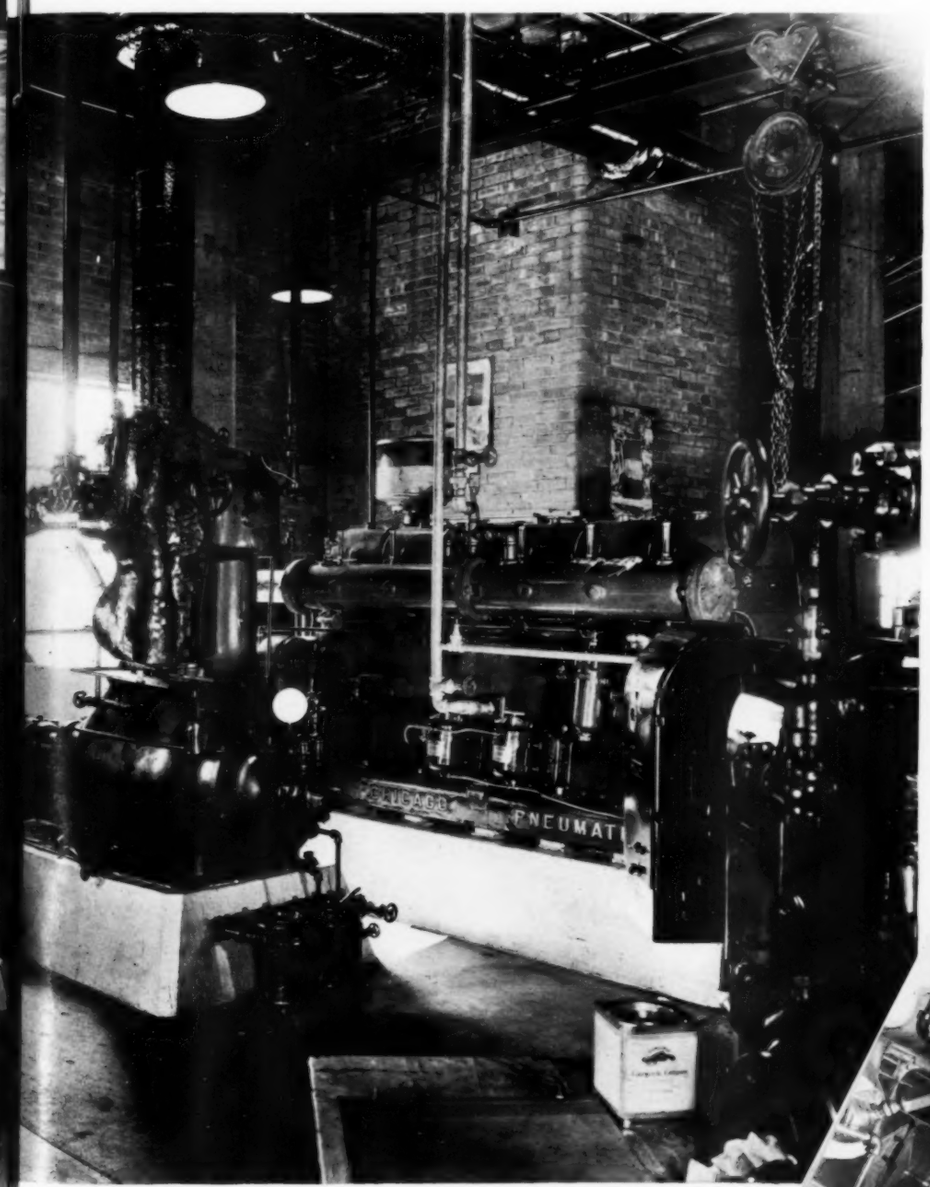
Annual cost of purchased power and light, average of three years, 1934-37:

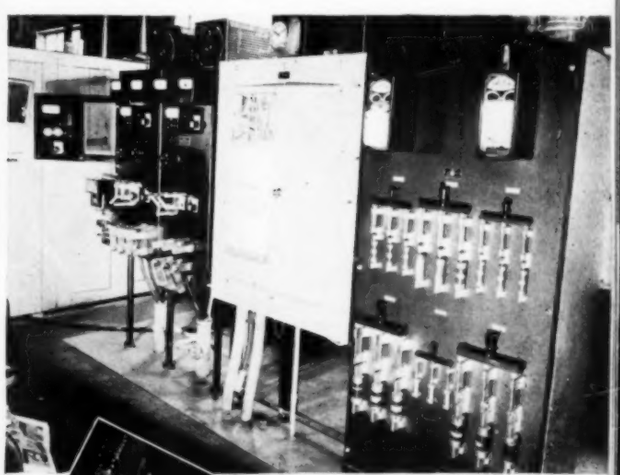
	Kwh.		*Per kwh.*
Plant power	797,266	$9,941.52	.0128
Arena Light	72,531	2,499.06	.0344
Total	869,797	$12,440.58	.0143

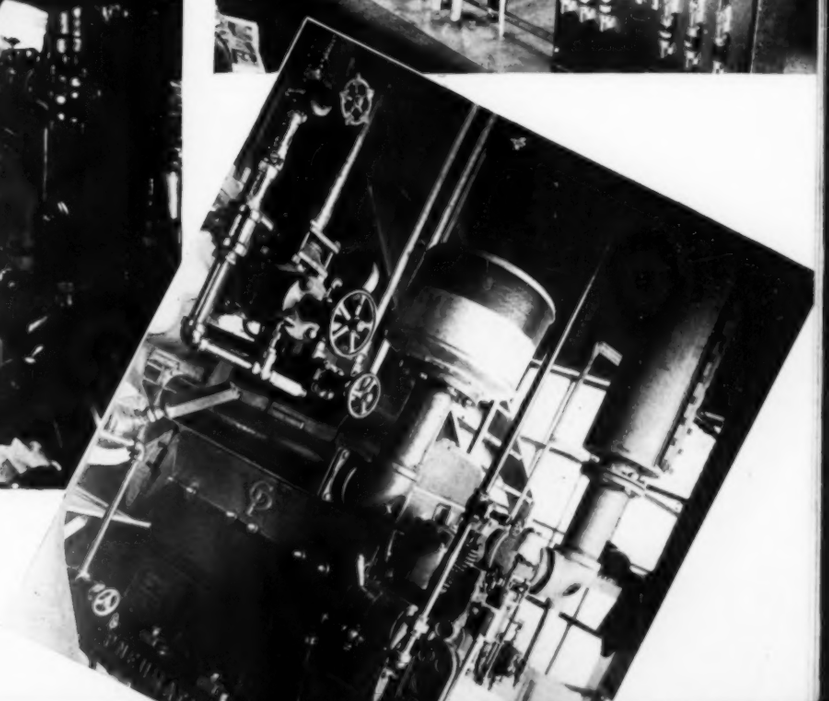
One full year of Diesel operation:

Cost of fuel (4¼c) and lube oil	$3,852.62
Maintenance	700.00
Purchased arena auditorium light, exit service	271.25
Total	$4,823.87
	$12,440.58
	4,823.87
Net annual Diesel operating savings over average purchased light and power	$7,616.71

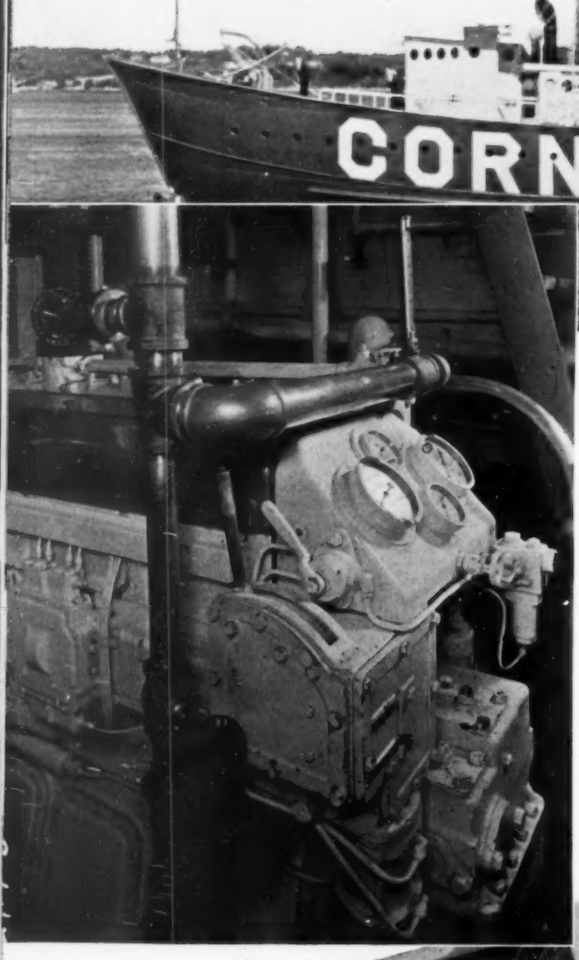
In spite of the wide load variation and consequent unfavorable load factor, this Diesel generating and refrigeration installation is meeting the engine manufacturer's claims and the owner's expectations by effecting a rate of savings in accordance with the amortization schedule.

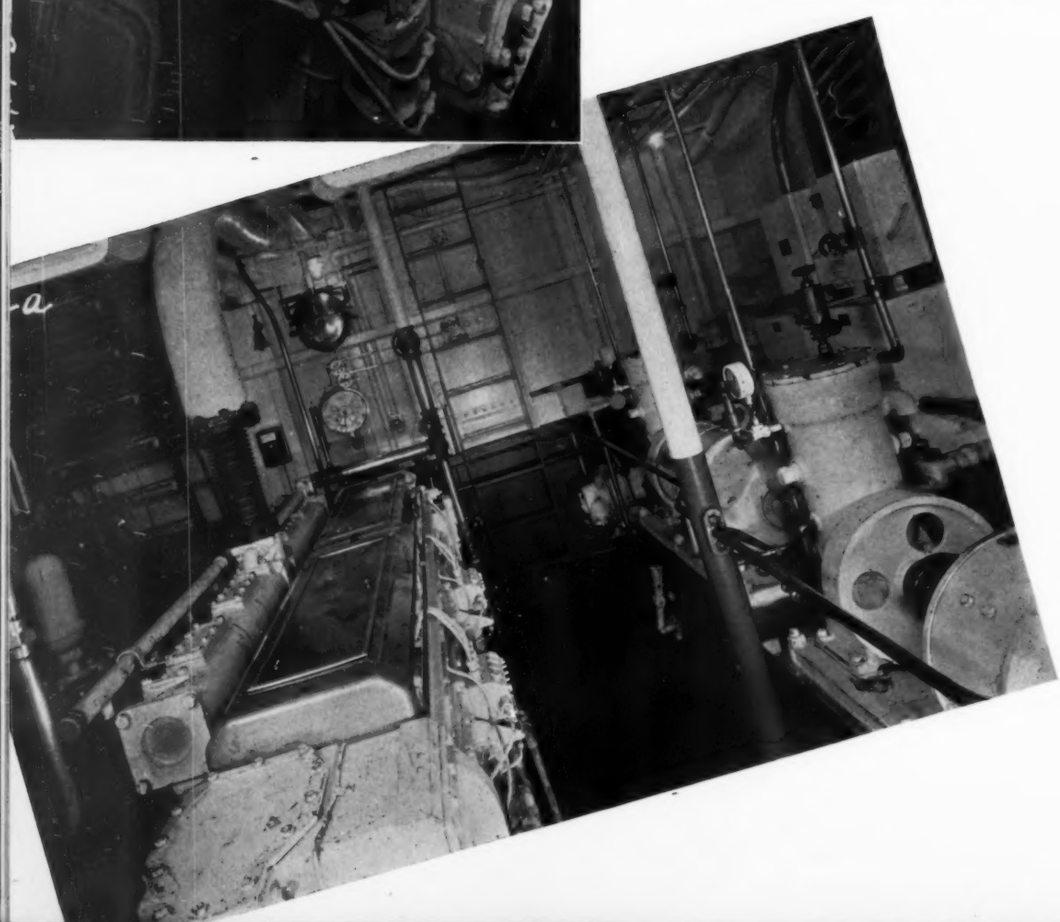






Left, partial view of engine room showing one of the two Diesels and the two ammonia compressors. Note that Yale hoists serve both engines. Next below, the switchboard and distributing panel; bottom, close-up of engine operating station showing Burgess intake air cleaner and silencer, Maxim exhaust silencer and Nugent filter.





Left—Cornfield Point Lightship, a familiar and welcome sight to Long Island Sound mariners. Left Center—View of main Diesel engine operating station. Lower left—General engine room view. Note Alnor Pyrometer just right of exhaust connection.

DIESELIZED LIGHTSHIP

ON April 25th, the U.S. Bureau of Lighthouses, within the Department of Commerce, placed in service the new No. 118 lightship. Built especially for the Cornfield Point Lightship Station, Long Island Sound, this new vessel embodies the very latest in lightship design and, though placed "on station" in a less exposed position than many of these guardian ships, it carries safety features comparable with those found in the newest of the lightships. Built at East Boothbay, Maine, by Rice Bros., shipbuilders, the vessel is practically all-steel construction, designed for extreme safety, and carries the most modern types of signaling equipment for the protection of human lives and marine shipping.

Main propulsion power is provided by a Cooper-Bessemer Type EN, 8-cylinder Diesel engine, which is direct-reversing and rated 300 hp. at a conservative speed of 700 rpm. This engine will provide ample power for the ship to maneuver during heavy weather and all emergencies, and to move to and from its station during regular inspection lay-up periods. A Westinghouse four-to-one speed reducer provides a propeller speed of 175 rpm. as compared to the 700 of the engine, and a flexible coupling by the same maker connects the engine shaft with the high speed shaft of the reduction gear.

Equipment for the main engine includes an eight-point Alnor Pyrometer and built-in lube oil pressure, lube oil transfer, fuel oil pressure and fuel oil transfer pumps. Fuel oil is filtered through a Duplex strainer and the built-in lubricating oil cooler is also equipped with this same type of strainer. A Maxim Spark Arrestor muffler is used.

Principal auxiliary machinery consists of two Worthington, 2-stage, motor-driven starting air compressors for starting the main Diesel engine, two 2-cylinder Hill Diesels, direct-connected to Electro Dynamic 10 kw. direct-current generators and two 38 hp. Hill-Diesels direct-connected to Gardner-Denver air compressors.

SEABOARD RAILWAY ANNOUNCES PURCHASE OF TWO NEW STREAMLINED TRAINS AND NINE ELECTRIC LOCOMOTIVES

NORFOLK, Va., September 15 – Seaboard Railway today announced the purchase of two additional *Silver Meteors* – streamlined, stainless steel, seven car, reserved seat coach trains, and nine 2,000 hp. Diesel-electric locomotives. The new streamliners will be placed in operation about December 1, and provide daily *Silver Meteor* service between New York and Miami, and every third day between New York and St. Petersburg. The Diesel-electric locomotives will power the new *Silver Meteors* between Washington and Florida destinations, and the West Coast "Orange Blossom Special" between Washington and St. Petersburg. The Pennsylvania Railroad electric locomotives are used on these trains between New York and Washington.

The *Silver Meteors* are being built by the Edward G. Budd Mfg. Co., Philadelphia, and the Diesel-electric locomotives by the Electro-Motive Corp., La Grange, Illinois.

COOPER-BESSEMER DIESEL-ELECTRIC UNITS FOR NAVY

FOUR Cooper-Bessemer Diesel engine generating units are scheduled for early delivery to New York Shipbuilding Corp., where they will be installed in new naval vessels.

The units are the maker's Type BN Diesel Engines, rated 150 hp. at 1200 rpm. and well-known to the navy through previous installations. These engines drive 100 kw. generators and are intended for emergency generating service aboard their respective vessels.

The four ships in which the Diesel sets will be installed are the destroyer tenders *Dixie* and *Prairie* and the seaplane tenders *Curtiss* and *Albemarle*.

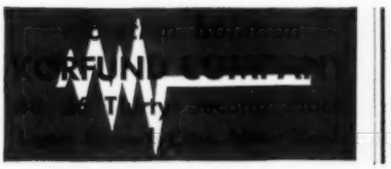
BUDA DIESEL ELECTRIC GENERATING SETS

THE Buda Company of Harvey, Illinois, has recently put on the market a complete line of standardized Diesel Electric Generating sets. These standard sets were designed after years of experience in the field with what might be termed "tailor made" plants. The equipment is of the latest design and has been proven in actual service.

The engines are designed with Lanova head and are amply proportioned and conservatively rated for continuous trouble free service. All

. . . . *And now please turn to page 47*

Steelbestos TWIN TYPE GASKETS
DIESEL Absolutely HOLDS WATER, OIL, AND COMPRESSION. COMPRESSES TO .010"
DETROIT GASKET AND MFG. CO. · DETROIT



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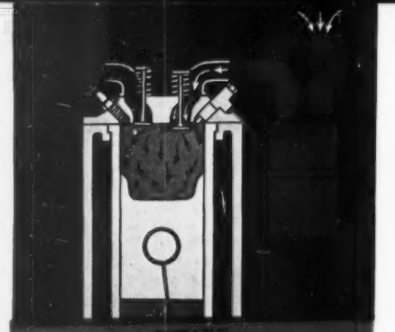
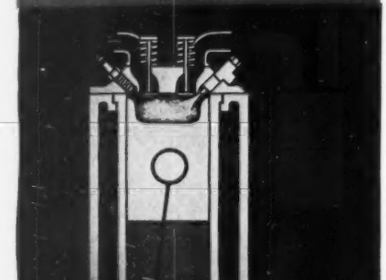
WESTON ELECTRICAL TACHOMETERS



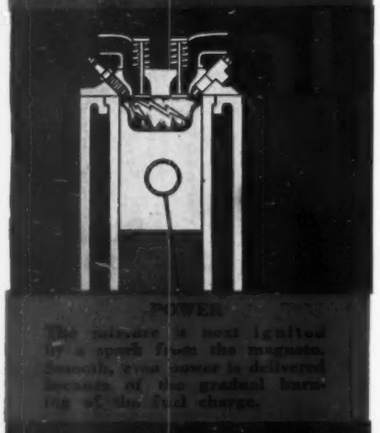
INTAKE

A measured quantity of cleaned air is drawn into the combustion chamber. The quantity is varied according to engine load by the governor.



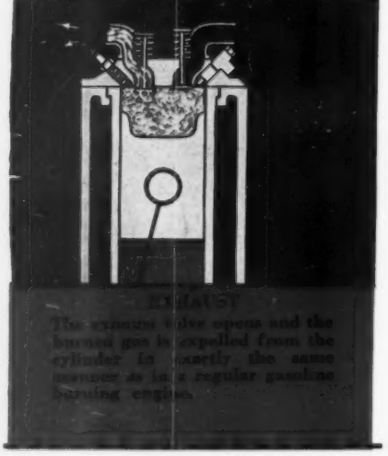
COMPRESSION

The air is next compressed to approximately 100 pounds pressure, 50° before top dead center. Diesel fuel is injected and thoroughly mixed with the air.



POWER

The mixture is next ignited by a spark from the magneto. Smooth, even power is delivered because of the gradual burning of the fuel charge.



EXHAUST

The exhaust valve opens and the burned gas is expelled from the cylinder in exactly the same manner as in a regular gasoline burning engine.

DIESEL ENGINE

A NEW ISSUE

CATALOG

PUBLISHED SEPTEMBER FIRST

ONE HUNDRED SEVEN DIFFERENT DIESEL ENGINES DESCRIBED AND FULLY ILLUSTRATED IN A 316 PAGE BOOK. SIZE 10¼" x 13½", WITH PLASTIC BINDING. A NEW BOOK, JUST PUBLISHED.

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DIESEL ENGINES DESCRIBED

Alco Four Cycle Stationary
Alco Universal Type
Alco-Sulzer "T" and "TM"
Allis-Chalmers
Atlas Imperial
Atlas-Lanova
Bristol "Phoenix" Diesel
Buckeye Diesel
Buda-Lanova Diesels
Busch-Sulzer Bros. 2-cycle
Busch-Sulzer Bros. 4-cycle
Caterpillar Industrial Engines
Caterpillar Marine Engines
Chicago Pneumatic Model 8-CP
Chicago Pneumatic Type RHB
Chicago Penumatic RHB-100
Clark Bros. Diesels
Clerget Aviation Diesel
Coatalen Aviation Diesel
Cooper-Bessemer Type EN and GN
Cooper-Bessemer Type JTB
Cummins Diesels
Davis & Thompson Yankee Diesel
De La Vergne Type VA
De La Vergne Model VB
De La Vergne Model VE
De La Vergne Model VG
De La Vergne Model VM
De La Vergne Gas Engines
De La Vergne Model VO
Deschamps Aircraft Diesel
Diesel Marine Auxiliary Units
Dodge Diesels
Enterprise Diesels
Fairbanks-Morse 33 and 37
Fairbanks-Morse Model 36-A
Fairbanks-Morse Model 36-A-8
Fairbanks-Morse Model 42-E
Fairbanks-Morse 32 and 35
Fairbanks-Morse Model 38
Fairbanks-Morse Model 46
General Motors Model 71
General Motors Model 567
Gray Marine Diesels
Guiberson Aviation Diesel
Hall-Scott "Chieftain"
Hamilton M.A.N. Engines
Hercules Diesels
Hill Diesels
Ingersoll Rand Type "S"
International Harvester
Junkers Jumo Diesel
Kahlenberg Engines
B.M.W. Lanova Diesel
Lister Small Stationary Diesels
Lorimer Diesels
Mack-Lanova Diesels
Mercedes-Benz
Murphy Diesels
Napier Culverin Diesel
Nordberg 4-cycle Diesels
Nordberg 2-cycle Diesels
Nordberg Gas-Diesels
Power Manufacturing Company
John Reiner Units
Ruston-Hornsby Horizontals
Sterling Crankless Diesel
Stover Single Cylinder Diesel
Superior Model "A"
Superior Model "D"
Superior Type M
Superior Type S
Titusville Iron Works
Venn-Severin Model "D"
Victor Horizontal Type
Washington Iron Works Diesels
Waukesha-Hesselman Type
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Worthington Diesels
Z.O.D. Aviation Diesels

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engines are provided with the very best in auxiliary equipment. Generators are designed to give long, trouble free, life.

The entire unit, consisting of engine, generator and radiator, where required, mounts on a heavy structural steel base provided with spring vibration dampers of Buda design, consequently these units may be installed in any location without fear of vibration.

Units may be purchased complete with all necessary auxiliary equipment such as silencers, generator panels, etc., or without the extra equipment. All sets are thoroughly tested before leaving the plant and are shipped ready for operation. Installation is simple with the new type base since it is not necessary to provide anything other than a good floor on which the unit is installed. On the largest units only 20 hold-down bolts are required.

These new standard sets are built in a wide size range from 5 kw. to 75 kw. both AC and DC. Bulletin No. 963 gives complete information about Buda-Lanova Diesel Generator Sets.

NEW BEARING ANNOUNCED

DEVELOPMENT of a new aluminum alloy automotive bearing with a long life, simple construction, and high fatigue strength has been announced by Aluminum Company of America. The bearing is applicable in bus, truck, tractor, Diesel, and airplane service, and its use is expected to extend to passenger cars. Applications include main, connecting-rod, and cam-shaft bearings.

Suitability of the bearing has been demonstrated by tests in many makes and types of engines and in special bearing testing machines. Aluminum bearings installed a year ago in a standard motor truck are in successful operation. Development of the new product culminates several years of intensive research in the laboratories of the Cleveland, Ohio, works of Aluminum Company of America. The work was done under the joint direction of L. W. Kempf, research metallurgist, and Frank Jardine, chief automotive engineer. On the basis of tests made, engineers list the advantages of the new product as follows:

1. A fatigue strength many times that of conventional bimetallic bearings used for the same purpose.
2. High resistance to corrosion by breakdown products of lubricating oils.
3. Economical construction because one metal does the job of two or more.

The present duplex or triplex bearing is made up of a steel half cylinder 0.05 to 0.075 inches

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LOWER OPERATING and MAINTENANCE COSTS resulted from the HILCO OIL RECLAIMER installation at the VALMEYER PLANT

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COOL YOUR DIESELS with "BUFFALO" Evaporative Water Coolers
Write today for Complete Information
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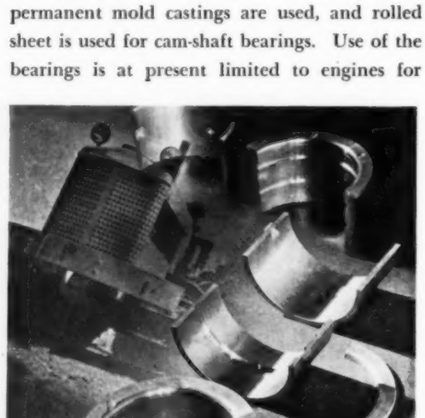
ALNOR EXHAUST PYROMETERS
ILLINOIS TESTING LABORATORIES, INC.
423 N. LASALLE ST. CHICAGO, ILL.

thick, faced with one or more layers of bearing metal. The bearing metal is usually either babbitt or a copper-lead alloy and is bonded to the steel. Most failures of the present bearings are not by friction, but by fatigue, either at the bond or in the bearing material. This behavior seems to be inherent in the complex construction.

The all-aluminum bearings were shown to have a superior resistance to fatigue. In a fatigue-testing machine, used for bearing tests, one bimetallic bearing failed at 20 hours, a second at 74 hours, while at 100 hours the aluminum bearing was still in perfect condition.

The aluminum bearings were also found to be satisfactory as far as friction is concerned. They did not score or lock to the shaft at the surface speeds met with in commercial vehicle engines. These bearing materials were developed by tests in a "scoring" machine which, in two minutes, can do to a bearing what the average operator hopes does not happen during the entire life of his vehicle. The results secured in the Cleveland experiments have been borne out by several manufacturers.

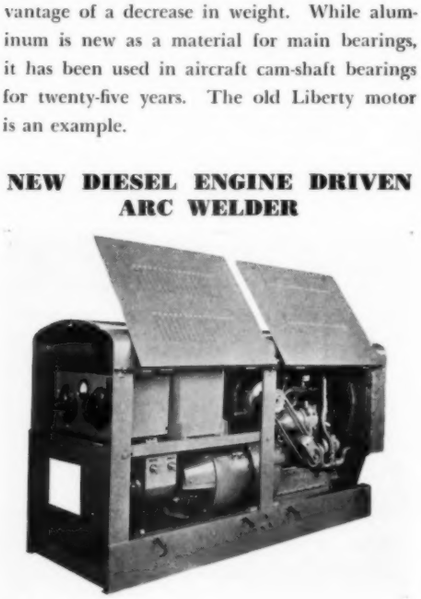
The aluminum bearing is not difficult to fabricate and can be finished by customary methods. The main requirement is that it be properly cast of the correct alloy with a thickness of at least 0.09 inches. For main and rod bearings permanent mold castings are used, and rolled sheet is used for cam-shaft bearings. Use of the bearings is at present limited to engines for



commercial vehicles which have hardened shafts and which operate for relatively lower speeds at the bearing surface than is used in passenger-car engines. Experiments, however, are now under way to adapt the new bearing to passenger-car engines.

Since the same types of engines may be used in either buses, trucks or tractors, the aluminum bearing is suitable for these vehicles. It may be used on either gasoline engines or Diesels. Tests in the plant of an aircraft engine manufacturer show that the bearing is suited to aircraft engines. In fact, it had a fatigue strength superior to any bearing material ever subjected to their testing apparaus. In aircraft, aluminum bearings offer an added advantage of a decrease in weight. While aluminum is new as a material for main bearings, it has been used in aircraft cam-shaft bearings for twenty-five years. The old Liberty motor is an example.

NEW DIESEL ENGINE DRIVEN ARC WELDER



A NEW 300 ampere Diesel engine-driven arc welder, which is equipped with gasoline engine starting rather than the conventional motor starter with storage batteries, a decisive advance in Diesel design, is announced by The Lincoln Electric Company, Cleveland, Ohio.

The gasoline engine used for starting the welder is a small auxiliary mounted above the Diesel engine. It is started by means of a hand crank. A belt drive, engaged by means of a clutch, connects the starting engine to the

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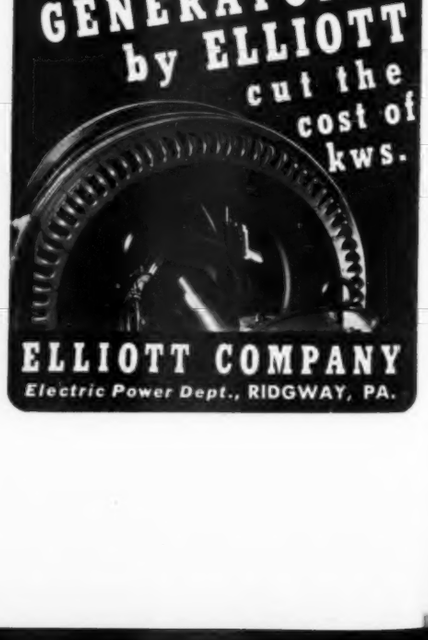


Diesel. Starting in extremely cold weather is facilitated by the fact that the cooling system of the small gasoline starting engine is connected into the cooling system of the Diesel. This arrangement makes it possible to warm up the Diesel by running the starting engine a short time and allowing the heated water to circulate through the Diesel engine.

The new Lincoln Diesel driven welder is said to cut fuel costs 33 per cent to 86 per cent, depending upon the type of fuel oil used. The Diesel uses only 1.5 gallons of fuel oil per hour at full load operation, as compared with 2.75 gallons of gasoline per hour in the case of the conventional gasoline engine welder drive. Total savings, including such items as transportation of fuel, loss, etc., are, in many cases, as high as 40 cents per hour.

The arc welding generator used on the new welder is the 300 ampere "Shield Arc SAE" unit, equipped with Dual Continuous control and all of the other features which make the "Shield Arc" such an economical weld producer. Dual Continuous control, by making possible the independent adjustment of both voltage and current, provides the right size and type of arc for all applications of arc welding.

BOSCH CHANGES

SEVERAL important changes in the sales organization of the American Bosch Corporation are announced in a statement issued by the management today.

Lee C. Carlton, formerly Sales Manager of the company's Western Division, has been appointed Manager of the newly created Sales and Engineering Service Division and will make his headquarters at the main office in Springfield, Mass.

Foster N. Perry, formerly Sales Manager of the Eastern Division, has been appointed Sales Manager of the Western Division with headquarters in Chicago.

Frank Oberle of the Springfield office has been appointed Sales Manager of the Eastern Division with headquarters in New York City.

Maynard A. Fowler, formerly local District Manager on the Pacific Coast, has been appointed Sales Manager of the newly created Pacific Coast Division with headquarters in San Francisco.

POSITION WANTED

Salesman of Diesel engines. Experienced and successful in engineering as well as selling. Willing to live anywhere. First class character references. Reply Box 122, DIESEL PROGRESS, 2 West 45th Street, N. Y. C.

Make a Sound Investment

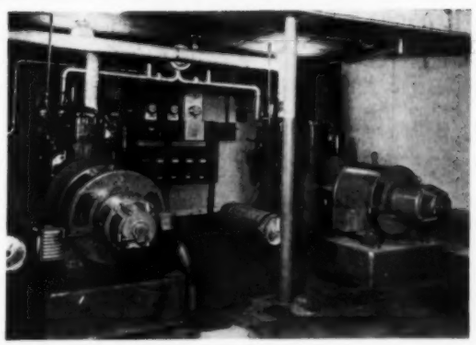
Safety First!

IT IS only natural that the new Cornfield Point Lightship should have the most modern and foolproof equipment attainable. That's why her Diesel engines — Cooper-Bessemer main propulsion, and Hill auxiliaries —are equipped with Maxim spark arrestor exhaust silencers. The Cornfield, which safeguards shipping, is in turn protected from noise and sparks by *Maxim.*

THE MAXIM SILENCER COMPANY
HARTFORD, CONNECTICUT **NEW YORK, N. Y.**

STAR GENERATORS

STAR Alternators are designed to meet the exacting requirements of private utility installations.
Star exclusive built-in voltage regulator, in which there are no moving parts, controls voltage on all phases. This feature provides especially fine voltage control.
Star welded frame construction is rugged and long-lived.
Star ratings insure satisfactory performance under continuous automatic operation.
Star engineering service will help you to secure the right generator characteristics for your job.



Two Star 40 kw. alternators serving the Duce Realty Block in Jackson Heights, Long Island. See article on pages 38 and 39 of this issue.

STAR ELECTRIC MOTOR CO.
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describes successful methods for effectively, safely and economically removing

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CHANGES AT STERLING

CHARLES A. CRIQUI, SR., the founder and for thirty-three years president of the Sterling Engine Company of Buffalo, announced today that he has turned the actual operation of his company over to younger executives, and he hopes in coming years to take a less active part in the direction of the corporation.

Mr. Criqui announced that the active heads of the company will be Spencer H. Logan of New York, the new president, and Addison F. Vars, Buffalo and New York advertising executive. Mr. Vars, who has been an officer and director of the Sterling company since the death of his father, Harry T. Vars, in 1926, fills a new post of executive vice-president. Charles A. Criqui Jr., continues as an official of the corporation and also has been named to the board of directors.

Mr. Logan, who is president of the Nutro-Sodium Corporation and a director of Consolidated Copper Mines, has for years been identified with a broad field of industrial and financial enterprises. He served as an officer in the U. S. Naval Reserve force during the latter part of the World War, prior to which he had been a member of the American Red Cross Commission to Serbia. He has been interested indirectly in the Sterling company since 1916,

Addison F. Vars

and has taken over the holdings of the late O. H. Foster and U. S. Thomas who, with Mr. Criqui and the late Mr. Vars, were the organizers of the corporation back in 1906.

Spencer H. Logan

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AN IMPORTANT NEW BOOK

BERNARD LESTER, who has been so successfully associated with the Westinghouse Elec. & Mfg. Co. for many years and who is undoubtedly one of the outstanding authorities in this country today on the training of industrial salesmen, has written a new book, "Applied Economics for Engineers," published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City, priced at $4.00.

This book provides an introduction to the practical aspects of economics, based upon conditions and problems which are encountered in engineering practice.

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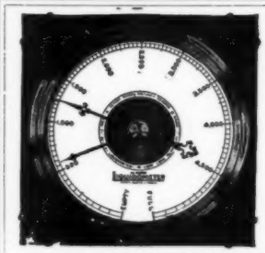

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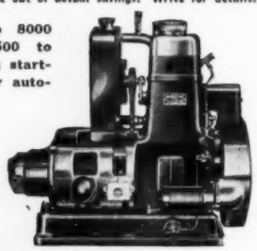

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Latest Diesel Patents

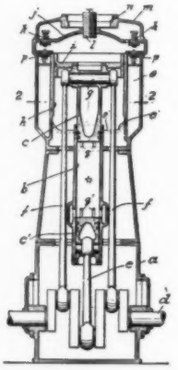
A description of the outstanding patented inventions on Diesel and Diesel accessories as they are granted by the United States Patent Office. This information will be found a handy reference for inventors, engineers, designers and production men in establishing the dates of record, as well as describing the important Diesel inventions.

Conducted by C. CALVERT HINES*

2,159,197
DIESEL ENGINE

Joseph Barraja-Frauenfelder, Swarthmore, Pa., assignor to Sun Shipbuilding & Dry Dock Company, Chester, Pa., a corporation of Pennsylvania.

Application October 7, 1937, Serial No. 167,766
1 Claim. (Cl. 123—51)



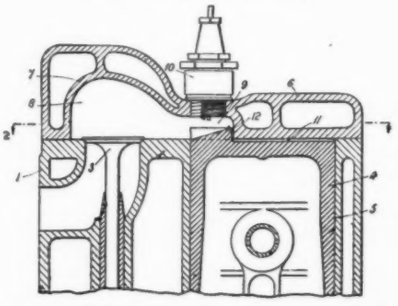
In an internal combustion engine a working cylinder, opposed working pistons in said cylinder, a crank shaft, side rods connecting the outer working piston to the crank shaft, a scavenging air pump comprising a cylinder circular in cross section and of a diameter to embrace said side rods positioned adjacent to the outer end of said working cylinder, and piston in said scavinging air cylinder connected to and adapted to be operated by the outer working piston, said scavenging air pump having a volumetric capacity in excess of the requirements of air for scavenging the working cylinder and having a ratio of compression such as to provide air for scavenging the working cylinder at a terminal pressure not substantially in excess of that required for scavenging the working cylinder without passage through the working cylinder of an excess of air.

*Patent Attorney, 811 E Street, N.W., Washington, D.C.

2,161,132
CYLINDER AND PISTON CONSTRUCTION

James P. Burke, Knoxville, Tenn., assignor of one-half to F. L. McLaughlin, Detroit, Mich.

Application August 27, 1937, Serial No. 161,309
8 Claims. (Cl. 123 — 191)

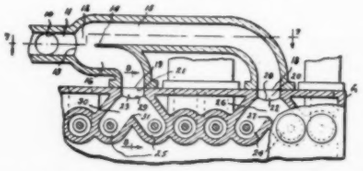


1. A piston having a flat top and a projection arising therefrom as a projection of an arc of the periphery thereof, said projection being of substantially zero height at the middle of said arc and tapering upwardly therefrom.

2,163,040
INDUCTION SYSTEM FOR INTERNAL COMBUSTION ENGINES

Enos R. Jacoby, Muskegon, Mich., assignor to Continental Motors Corporation, Detroit, Mich., a corporation of Virginia

Application February 26, 1938, Serial No. 192,722
10 Claims. (Cl. 123 — 52)



1. An induction system for a multi-cylinder engine having in combination, a cylinder block having a pair of cylinder intake passages each individually communicating with a cylinder intake port, said block having a partition separating said passages and providing a split, said induction system further including a distributing chamber located ahead of said split substantially within the cylinder block, and a secondary conducting portion ahead of said distributing chamber, said secondary conducting portion having a portion thereof adjacent to said distributing chamber constructed to provide a substantially straight closer conduit having a length sufficient to permit the fuel mixture flowing therethrough to attain substantial equilibrium prior to being inducted into said distributing chamber, and an arcuate fuel impeding means located substantially adjacent to the outlet of said conduit and acting on the fuel precipitate flowing into said distributing chamber to substantially reatomize the same and to selectively direct wet fuel in the cylinder intake passage open to engine suction pressure.

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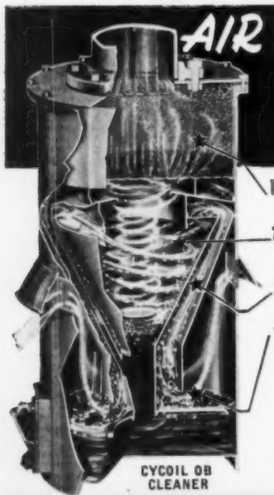
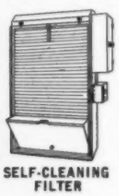


CYCOIL OB CLEANER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Type OCH filters are washable viscous impingement type air filters. Ask for Bulletin No. 120-B.

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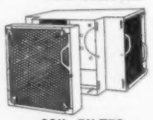
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